Report of

INNOVATIVE CITY FORUM
2016

2016.10.19(Wed)—20(Thu)

Contents

【Overview】

Date: October 19 [Wed.]–20 [Thu.], 2016
Venue: Toranomon Hills Forum
Venue Capacity: 400
Language: Japanese and English simultaneous interpretation
http://icf.academyhills.com/en

Hosted by

Institute for Urban Strategies
THE MORI MEMORIAL FOUNDATION

MORI ART MUSEUM

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Co-hosted by

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MIT Media Lab

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Link to Good Living

Panasonic

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ハイパフォーマンスの実現へ

dentsu

TOPPAN

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ICF2016 is a cooperation event of World Forum on Sport and Culture.

World Forum on
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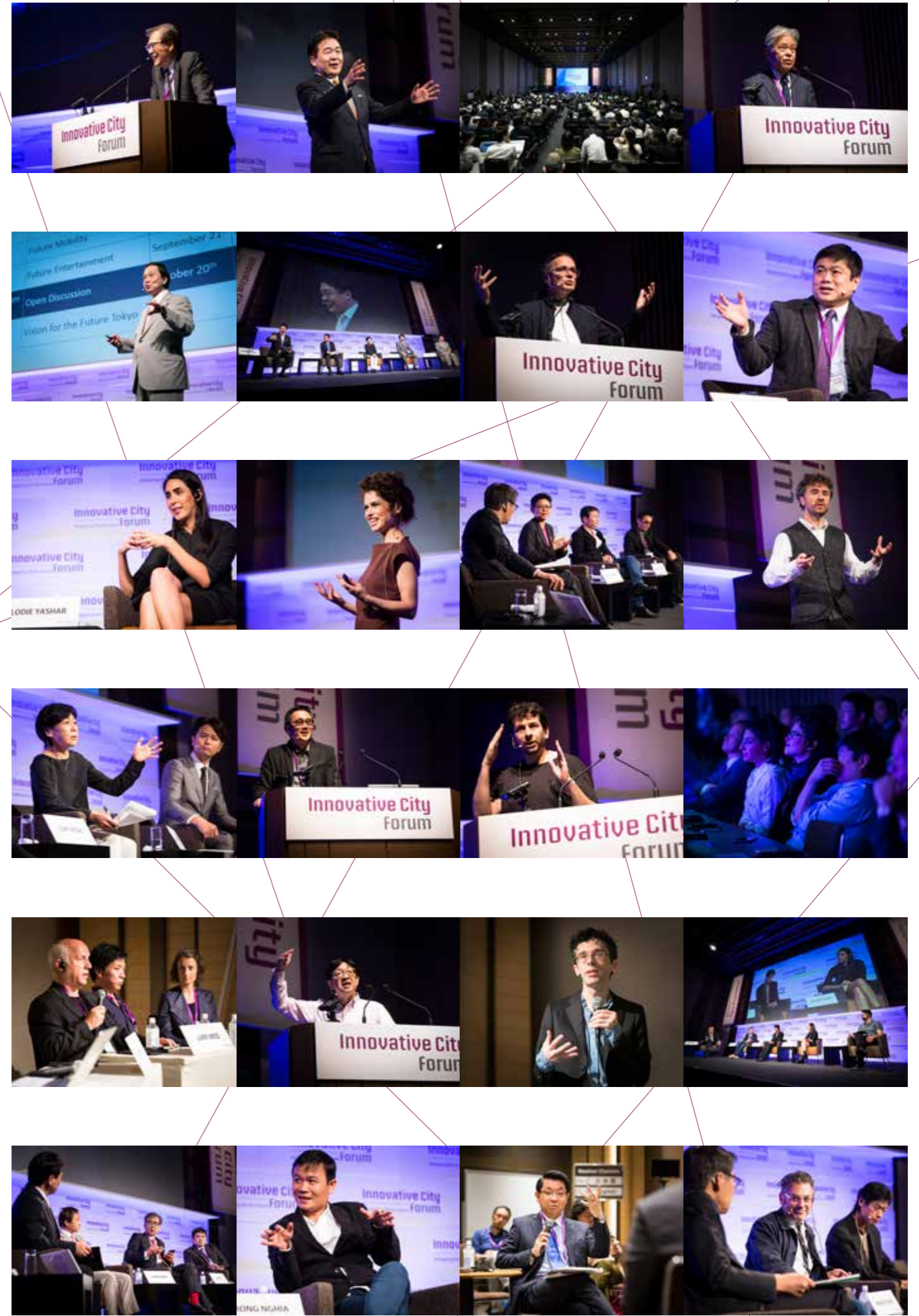
WELCOME ADDRESS

CITY BRAINSTORMING

[**Opening questionnaire result**]

47.6%
20.5%
14.8%

38.3%

What will the city ranking of Tokyo be in 2020, the Olympic year?

What is the most necessary element for Tokyo to seek the best city in the world hereafter?

17.0%

47.7%

14.1%

■ Economic power

■ Cultural power

■ Technological power

■ Infrastructure development

■ Will be higher

■ Will be lower

■ Will stay the same
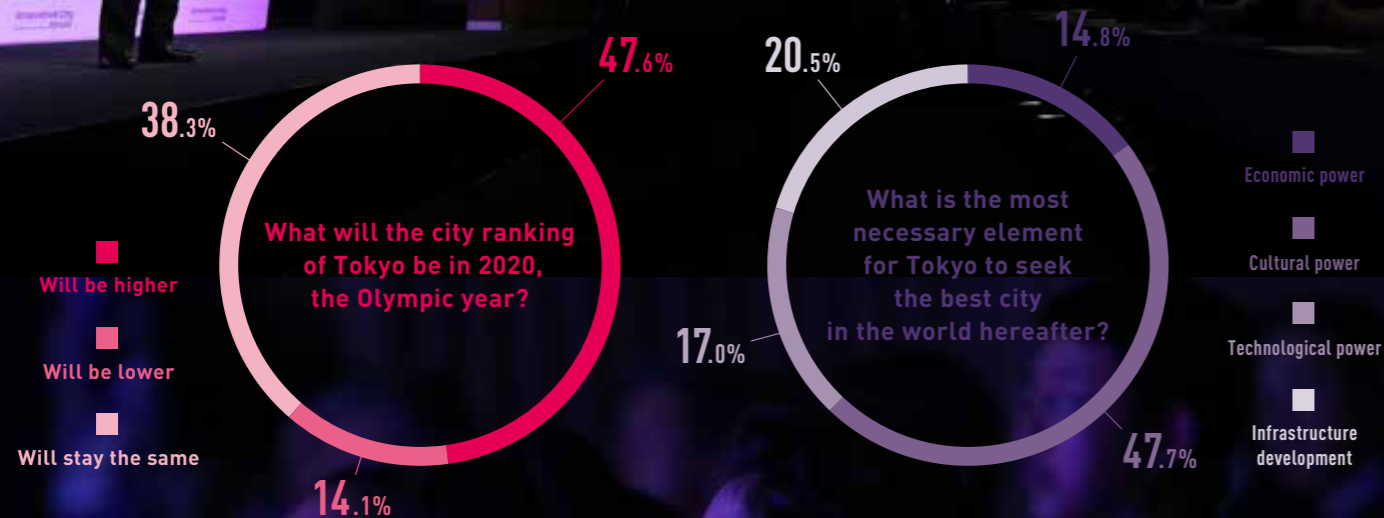
Tokyo's Future Needs "Cultural Strength"

Innovative City Forum 2016 opened with an address from Mr. Heizo Takenaka, chairman of the Institute for Urban Strategies at the Mori Memorial Foundation, and Mr. Hiroyasu Ando, president at The Japan Foundation, which hosted ICF2016. Mr. Takenaka presented an assessment of the current state of the city of Tokyo and its future prospects, for the purpose of discussion at the various sessions of the two-day Forum to follow.

The city has taken on tremendous significance as a site that enables innovation through new connections made between people, companies, ideas, and every combination thereof. Furthermore, in relation to the phenomenon known as the Fourth Industrial Revolution (or "Industry 4.0") as represented

by advancements in areas such as artificial intelligence, big data, robotics, and the sharing economy, the city will play the critical role of providing a progressive lifestyle. The arts have been identified as a source of the creative personnel who will bring about the city's new state of being. The presentation also indicated that the fusion of art and technology could open a path to the lifestyle of the future.

As for the "City Brainstorming" that took place after the Welcome Address, a platform was provided to consider issues surrounding the city of Tokyo, by way of an interactive survey of Forum attendees. The audience was asked questions about the current direction of the world's cities, their predictions as

to where Tokyo will rank as a city by its Olympic year of 2020, the element Tokyo ought to pursue in order to become the best city in the world, and their thoughts on how Tokyo would fare under the administration of Governor Yuriko Koike. What emerged from their answers was that many participants

had high hopes for Tokyo's future, and that expectations for the city have been growing over the last few years. Over the following two days, the Forum would move on to the Session portion, with participants' awareness of these issues forming a common foundation for the discussions to follow.

——**A city that brings forth a new lifestyle by forging connections between people, companies, and ideas**

——**Now, amid the Fourth Industrial Revolution, the city plays an extremely significant role**

——**Tokyo expected to grow, as confirmed by a survey of attendees**

KEYNOTE ADDRESS 1

"Heatherwick Studio: Ideas for the future."

——**In order to stop the 'destruction of old buildings and making of new ones', the utilization of heritage is indispensable**

——**Through the power of design, I want to bring together the people and cities that have been divided**

——**Today, as cities are developed to be homogenous, I hope that originality will be nurtured in Tokyo**

KEYNOTE SPEAKER

THOMAS HEATHERWICK

Founder and Design Director, Heatherwick Studio

The Design Needed in Urban Development is Connecting the Old with the New

Since being appointed as the youngest Royal Designer for Industry in 2004, Mr. Thomas Heatherwick has been the most important person on the world's design scene. Heatherwick Studio is known for such projects as 'Seed Cathedral', the outstanding UK pavilion at the 2010 Shanghai World Expo, and the transformation of London's famous double-decker bus, and they are currently engaged in projects worldwide. In his keynote speech, there were four keywords that symbolized the studio's creative activities – redefining heritage/ soulfulness/human scale/future places.

First, he looked at the New Bus for London project, advocating the importance of 'redefining heritage'. In the research stage of the project, Heatherwick Studio focused on the fact that there are as many as 7,000 red buses in London, and they are seen more frequently than specific buildings. As a result, he pointed out that although

there are various examples of cultural heritage in London, they include not only buildings but also the famous red double-decker buses. As one of the few studios that have the privilege of creating new projects in cities, he pointed out that he wanted to stop "destroying old buildings and making new ones", and revealed his desire to make better use of heritage.

The second keyword, 'soulfulness' takes the perspective of how people can feel affection for inorganic buildings or cities. This was explained through the case of the Learning Hub at Nanyang Technological University, newly built in Singapore in 2015. Developed with the aim of promoting communication and the emergence of new ideas, this building tends to attract attention for its unique shape, but in fact there is also ingenuity on the surface of the walls. By applying irregular, three-dimensional decorations to brown concrete, unlike a flat and inor-

ganic wall surface, it was finished so that even as a newly opened building it was a comfortable space.

Based on the theme of the ongoing Google California project with New York architectural design office "BIG", the biggest collaborative project of the past few years, 'human scale' was introduced as an important point of view for achieving compatibility between huge architecture having the size of an airport and a single person. He pointed out that even in a building where 80,000 to 90,000 people come and go with thousands of people permanently in the building, there is a demand for spaces of the size most suitable for human senses and activities so that the presence of each person is not diminished.

For 'future places', Mr. Heatherwick introduced the Garden Bridge, a bridge that connects both banks of the River Thames and features a garden where people can gather. He touched on the

fact that in the past, cities would be formed around a river, but now cities are transfigured so that they are divided by the river. His hopes are to bring people together, to bring communities together, through the power of design. The bridge was conceived as a meeting place and, as the name "Garden Bridge" suggests, the finished design is full of natural beauty. As a slide showing the architectural renderings was displayed during the presentation, the sound of camera shutters echoed around the venue.

Finally, while touching on the problem of current urban development that sees all cities developed in a homogenous way, Mr. Heatherwick, who travels frequently between various cities around the world, said he hopes that there would be discussion at Innovative City Forum about what is needed in order for Tokyo to continue to exhibit its originality in the future.

KEYNOTE ADDRESS 2

"POST POST-CITY"

—The 'POST CITY' presented
by Ars Electronica Festival

—Ars Electronica is a participatory festival
and culture institution
that involve technologies
that reflect the changing nature of cities.

—In the future which will see a shift from impersonal things
to personalized things (as seen in IoT), there is potential
in the Japanese culture of animism that finds "souls"
in things similar to individual traits or personality

KEYNOTE SPEAKER
GERFRIED STOCKER
Artistic Director, Ars Electronica

KEYNOTE ADDRESS 3

"MACHINE INTELLIGENCE, ART, AUGMENTATION AND AGENCY"

—Machine intelligence has taken on
a sense of reality.

—A resurgence of interest in fundamental
neural engineering is leading the way
for the blossoming of computer creativity.

—There is a need for a neural network free
from social bias.

KEYNOTE SPEAKER
BLAISE AGÜERA Y ARCAS
Principal Scientist, Google

A City is Not Infrastructure, but a Place for Communication

Mr. Gerfried Stocker, who serves as artistic director for Ars Electronica, gave a lecture focusing primarily on "POST CITY," the theme of the 2015 Ars Electronica Festival. Posing the question of how cities of the 21st century will become for us who are living a novel lifestyle as a result of the digital revolution, he showed that our age has already entered a phase where the city should no longer be looked upon as infrastructure but instead as a space for communication and dialogue.

Since the time it hosted its first festival in 1979, Ars Electronica has consistently hosted participatory projects using media — such as radio — that anticipated the social media of today. As seen in the case of Ars Electronica Center, an institution with an educational focus that bridges the gap between a broad spectrum of people and technologies, Mr. Stocker explained

that Ars Electronica has also responded to the transformation of cultural establishments that has accompanied the changes in culture and art that have come in response to changes in the city.

He explained that when thinking about "POST POST CITY," in other words, "what comes after POST CITY," it is important that we not simply think about what appearance cities present, but that we understand the opportunities that await us in cities and whether we can make use of these opportunities. As a good example, he introduced "House NA," by Sou Fujimoto Architects, a house that has glass on all sides, fusing what is public with what is private. He also added that in cities where identity becomes fluid, and especially in Japanese society, a driving force of innovations will come from the

changing role models e.g. for women, who are going to play a much stronger part in our societies.

Mr. Stocker also mentioned that in smart cities, which are made up of intelligent, autonomous systems, it is possible to think about new cities driven by relationship changes between people and cars as new forms of communication are explored between — for example — driverless vehicles and pedestrians. He stated that the true challenge lies not in building driverless vehicles, but in understanding the new ecosystem for movement that will emerge from the process. In other words, he said, what is important is not focusing on the technology itself, but rather understanding the technology and determining how it will develop. Mr. Stocker concluded that in a future in which technology will change from impersonal things to personalized things

(as seen in IoT), he pointed out the potential of the Japanese culture of animism that finds "souls" in things similar to individual traits or personality, and encouraged the participants.

The Potential of Computers with Creativity

A principal scientist at Google, Mr. Agüera y Arcas is conducting research into the relationship between physiological brain function in humans and artificial neural networks. Mr. Agüera y Arcas' view, as he explained in a recent presentation, is that computers should not simply be regarded as tools for analysis or calculation; rather, he spoke of the creativity of machine intelligence, and the power such art media has to shape society.

Beginning in the 19th century, neuroscience and computer science, which had previously been closely interrelated, each developed individually as separate disciplines. However, about ten years ago, with deep learning, people began to take interest in fundamental neural engineering once more, explained Mr. Agüera y Arcas, speaking about the history of his research. This led researchers to realize the creative

potential of machines, he said.

For example, by running a program capable of recognizing images of birds as birds in reverse, new images of birds may be generated. In other words, feedback loop based creative processes — capable of creating order amid all the chaos and noise, in the form of images — are now being actualized. It may eventually be possible to reproduce the processes which occur inside the human brain technologically. Such systems are architecturally similar to the human brain, and are rapidly approaching something we can call intelligence. Furthermore, this neural network could potentially be used for personal devices. Even without connecting multiple devices under centralized management and conducting training using masses of data, learning would be possible through local, decentralized means.

Finally, Mr. Agüera y Arcas addressed the issue, likely to be a subject of concern in the future, of data collected by such personal devices, from society and media, and the biases generated from this data through learning. He stressed the need to develop technology that eliminates discrimination and prejudice to create a neural network free from bias.

LEADING-EDGE TECHNOLOGIES

SESSION 1 "SYMBIOSIS WITH ARTIFICIAL INTELLIGENCE"

Coexisting with AI Carrying Various Problems Will Require Deliberate Preparation

Speakers Mr. Hiroaki Kitano and Mr. Blaise Agüera y Arcas, together with Mr. Joichi Ito of the Program Committee, held the panel discussion for the session on leading-edge technology.

Mr. Ito began by quoting from an article published in Nature magazine: "Society will feel threatened if computers become smarter than people, but with people continuing to be superior, society has not become smarter." After this reference to the importance of AI, the discussion started off by considering how AI is positioned in society.

Mr. Agüera y Arcas, who researches machine learning at Google, said that because the bias involved in data learning in AI will not go away, not everything can be automated. He said that under certain conditions, AI must be positioned assuming a bias.

Mr. Kitano acknowledged the existence of bias, but stated that the question is also how far human beings can be trusted. He added that it is precisely because accidents due to human error will not go away that automatic driving and autonomous cars have come into existence.

Ito astutely pointed out that bias can crop up even in the idea of "safety," noting that in discussions of AI there arises the ethical question of whether, if an autonomous car carrying a rich person has an accident, the rich person should receive rescue assistance prior to other people.

Ito then focused on "federation" for the purpose of unifying AI, stating that even if a large number of computers are linked together they do not become smart, therefore it is important to make the best use of existing computers. Mr. Kitano added that artificial intelligence systems all have different strengths and weaknesses due to differences in their algorithms, their learning data, and so on, so what is needed is to combine them and make full use of them.

All three speakers were in agreement that, in exploring the positioning of AI in society, attention should be focused on networks rather than individual units. The discussion then moved on to what sort of decision making AI should carry out in cities. Mr. Agüera y Arcas brought up as an example the RoboCup that were discussed in Kitano's presentation, saying that unless multiple robots make decisions autonomously while communicating with each other, the urban system will become fragile. Mr. Kitano concurred that it is important that robustness be built in.

Mr. Ito, on the other hand, taking into consideration the evolutionary theory of the survival of the fittest, pointed out that — due to a great lack of time — it would probably be difficult for humans to build up from zero a system that would have robots survive and evolve as species. He said that the question of how society and robots will evolve while cooperating closely is also interesting. He commented that we should focus on the difference between Western society, which is trying to tax AI on the grounds that it steals work, and Japan, which seems to be compatible with AI for reasons both of religion and of a social structure that features a short-age of labor.

In addition, on the question of AI and work, Mr. Ito advanced the idea that today, when there are different levels of awareness regarding employment, it is important that planning be done with a view to a future in which AI will be leveled. At the same time, he hypothesized that when AI becomes a solution that aids work, then optimization will probably be more important than boosting efficiency, saying that such measures of optimization as happiness and GDP, as well as the value of AI for mothers, can be measured and created.

The discussion closed on the note that some sort of engine is needed in order for AI to academically and — above all — culturally assimilate into society, and that in the long term the outlook seems optimistic.

—The societal value of AI is greatly dependent upon ethical considerations

—The ability to track coevolution between AI and society by comparing the spread of AI in the West and in Japan

—AI is more useful for optimizing solutions than for making them efficient

Positioning AI at the Periphery of Human Ability

Mr. Hiroaki Kitano, who has been at the forefront of artificial intelligence research since the 1990's, has served as a representative of the Sony Computer Science Laboratory, which has produced a great number of excellent researchers, and has the influence to be considered the authority on artificial intelligence research. A good example is that Mr. Kitano started the international robot competition "RoboCup" in order to bring together the world's best minds.

"RoboCup", which takes the theme of football and its rules that are common all over the world rather than natural disaster relief or nursing care, can be said to have prepared a stage where researchers from all over the world can participate. Speaking about the results of 20 years of RoboCup, Mr.Kitano introduced the research team of Cornell University, who won four consecutive RoboCups, started a warehouse robot company called "KIVA Systems", and were bought out by Amazon for approximately 80 billion yen, illustrating how the technology cultivated at the competition has greatly helped logistics to evolve. The intent of establishing the

RoboCup, which is to transform society and industry with the technology created in the research process, is being embodied in a splendid way.

After the competition robot, he talked about the way autonomous robot technology is appearing in our towns, as demonstrated through the case of the world's first automatic taxi service with ordinary people on-board. One after another, small technologies line up, and we can reconfirm the view of the world where sophisticated technology – the "city" – is built, further enhancing our expectation of artificial intelligence and robots as an expansion of the "city".

Meanwhile, while introducing a wide range of research in the context of "human" expansion, Mr. Kitano said that there is a strong interest in achieving scientific discoveries with artificial intelligence, which until now can be said to have largely depended on serendipity. As a backdrop, he cited the fact that enormous numbers of papers (for example, more than 1.5 million cases per year in the biomedical field) cannot be read by researchers, the fact that humans cannot describe things exactly as

they see them due to cognitive bias, as well as the fact that language can cause ambiguity in the recognition of a given situation, and he clarified the limit of scientific discovery by a single human being. For example, when 99% of papers are A, and 1% of papers assert the opposite of A, in the case of human beings, it is highly likely that they will overlook or ignore that 1%. But if you use artificial intelligence to utilize big data, large scale parallel computation, and advanced machine learning technology, he said, things that people were missing become visible, and furthermore, by managing the

search work, it will become possible to create new scientific information and knowledge. While presuming coexistence between artificial intelligence and people, it can also be said that it takes the form of two stages. In the future, when discussing more concretely symbiosis with artificial intelligence in society as a whole, since there is a possibility that the artificial intelligence that creates the knowledge of the latter itself can surpass people, there will be a need for artificial intelligence to pursue useful steps as the outer limit of "human" ability, beyond countries or disciplines.

—The place where robot researchers from around the world gathered to solve social problems 20 years hence is 'RoboCup'.

—Artificial intelligence and robots will bring about logistics and automated driving as urban expansion, and scientific discovery as human expansion."

—Artificial intelligence evolves from 'tools that help thinking' to 'tools that create knowledge itself

SPEAKER

HIROAKI KITANO
President and CEO,
Sony Computer
Science Laboratories, Inc.

BLAISE AGÜERA Y ARCAS
Principal Scientist,
Google

MODERATOR

JOICHI ITO
Director,
MIT Media Lab

LEADING-EDGE TECHNOLOGIES SESSION 2

"New Metabolism: Krebs Cycle of Creativity"

The Importance of Straddling Various Fields by Oneself

"Antidisciplinary" is a whole concept of research which straddles multiple distinct fields which seem unrelated to the current state of the art. The JoDS (Journal of Design and Science) promotes schools of thought aimed at bringing narrowly conceived design into broader contact with science. Mr. Joichi Ito, Director of the MIT Media Lab, served as the moderator and introduced Ms. Neri Oxman, associate professor of Media Arts and Sciences in the Lab, as the representation of the creator ethos of this new generation, after which she gave a presentation. Ms. Oxman is an architect, designer, founder of and the person behind a research group within the Lab which studies the integration of digital design

with biological design. In our modern age known for being in the Fourth Industrial Revolution, she has freed design from constraints imposed by the manufacturing industry in the past and strives to combine ecology with the world of man-made objects, based on the concept of "material ecology". It has been said that all products created with this concept seem to come alive while at the same time maintaining an intimate relationship with the surrounding environment.

For example, in the Wanderers series—one of the projects introduced by Ms. Oxman—is a wearable designed to be a life support suit for human interplanetary travel. This wearable incorporating synthetically engineered microorganisms is conceived as a living wearable which facilitates the survival of humans in the harsh environment of space. Because these projects were realized with 3D printing technology which can freely manipulate density, color, and shape, Mushtari—an integration of a wearable with a biological organ system—combines E. coli bacteria with cyanobacteria capable of photosynthesis. She explained that the cyanobacteria create sucrose via photosynthesis, which the E. coli consume and use to generate biofuels. Ms. Oxman said that this

product is similar to a digestive system located outside of the human body but which, at the same time, continues to grow on its surface.

After that, applications for urban planning are just a small step from this material ecology approach, said Ms. Oxman. Besides Ocean Pavilion—a large scale exhibit of transparent, water-soluble biodegradable materials representing the first foray of a designer into the domain of chemistry—, Ms. Oxman has also jointly developed the 3D printing of glass. While only small projects are underway at the moment, she indicated that they are aiming to exhibit large-scale works in the future through a process not unlike repeating an ongoing experiment. Against this backdrop, she said that refined shaping of the internal structure of glass was possible and presented a vision of the future where it is possible to seriously consider the biological regulation of architectural structures.

—At the heart of material ecology are "digital design" and "biological design

—Create materials which support human life and wearables which grow microbes

—Reform of urban planning and architectural structures based on biological networks

—Conceived half a century ago, Metabolism is finally feasible with the advancement of technology

—Designers and architects are at the heart of the design revolution brought about by biology

—Creativity cannot be demonstrated without learning about physical elements such as movement and shape

Modern Technology is Giving Shape to the Dream of Metabolism

After Ms. Neri Oxman's speech, she was joined by Mr. Joichi Ito and the two members of the MIT Media Lab talked about metabolism, digital design, and the relationship between science and art.

First, Ms. Oxman talked about her deep association with Metabolism, having grown up with parents who were architects that respected the works of Metabolism, and mentioned an episode where she had a poster of Tokyo Bay in her room from a young age. And, while evaluating the Metabolism architects who conceived a positive future for postwar Japan, she pointed out that, if at the time they had had the knowledge of biology and digital tools that we have today, they might have been able to accurately realize their concepts. Specifically, she added that although it was designed for assembly at that time, now it can be created not only as a so-called metaphor but in reality, as we have all the tools with high computing

power and high resolution that also enable designs to be made at genome size. Ms. Oxman also explained that modern designers and architects are at the center of the revolution, and biology is at its heart.

In response to Ms. Oxman's remarks that the progress of technology empowers designers, Mr. Ito spoke about the possibilities for designers and architects. He mentioned that designers like Ms. Oxman can make tools, and if it is possible to actually create and use those tools, the output of creativity may change. He also pointed out that if you do not understand tools and science, you cannot make complicated architecture or imagine something new by looking at completed structures.

Ms. Oxman described the material success scenario of contemporary designers and architects by way of the example of placing a microscope on a desk. That meant you could change your per-

ception by seeing the world using different lenses, leading to a new way of looking at architecture and products. She explained that by looking at the world through a lens not at the human level but at the microbial level, you can obtain something of significance.

Agreeing with Ms. Oxman's remarks, Mr. Ito expounded that unless physical

elements such as movement and shape are learned, creativity cannot be exhibited in that area. From this, he said, art is a physical recognition while at the same time converting a certain cognition into science, and encompassing various perspectives will become a human resource that connects art and science.

MODERATOR

JOICHI ITO
Director, MIT Media Lab

SPEAKER

NERI OXMAN
Associate Professor,
Media Arts and Sciences,
MIT Media Lab

Tom Sachs is an artist who works primarily as a sculptor. His projects utilize methods related to cultural anthropology such as bricolage, where new products are assembled from whatever materials are on hand, and imitative techniques, where related objects are presented together in order to represent a causal relationship. These methods have driven Mr. Sachs ever since he constructed a camera out of clay when he was 10 years old.

For example, a guillotine featuring the Chanel logo is on exhibit at the Pompidou Center in Paris. Mr. Sachs states that the placement of his guillotine, which represents a part of the history of France, into the permanent exhibition at the Pompidou center, speaks to the provocative power achieved by combining objects with icons. In this way, he aims to create works in his studio where the whole is greater than the sum of its parts, and where various elements react with each other to stimulate a viewer's intuition.

While Mr. Sachs previously used icons that invoked the McDonald's brand to create works that confront consumer society, he has recently trained his attention on projects relating to space exploration, represented by NASA. What Mr. Sachs interrogates through his pieces that imitate the Apollo moon landing or tell the story of the first women to land on Mars is nothing less than our worldview and the way in which objects are made. Furthermore, he says that his project imagining the exploration of Jupiter's moon Europa, which is thought to harbor life, uses the activity of collecting life on Earth to re-examine humanity's colonialist impulse.

In recent years, many of his pieces deal with tea ceremony as a method of reexamining human activity in space. One of these is a handmade and misshapen tea bowl engraved with the NASA logo. Mr. Sachs states that his own fingerprints are likely to remain on the bowl for 2,000 years. Other works include an electronic and fully automated tea whisk, which aims to immediately perfect an action that is said to require a human to practice it 5,000 times. These works and other examples wherein the artist freely combines icons to express his unique worldview were on display at the venue.

—Applying bricolage, previously used to rethink the tenets of consumer society, to the problems of space.

—By recreating spaceships and the NASA logo, these works questions our worldview and the way in which objects are made.

—The artist works to carve his 'fingerprint' into the assemblage of icons that make up his works.

ART & CREATIVITY SESSION

SESSION 1 "THE UNIVERSE AND LIVING IN THIS EXTREME ENVIRONMENT"

A co-founder of The Center for Genomic Gastronomy, researcher at the Dublin Science Gallery and artist, Mr. Zack Denfeld introduced the center's initiatives that he leads.

Established in 2010, the center, which researches the biotechnology and biodiversity of human food, has cooperated with scientists, chefs, farmers and hackers and is a think tank that develops projects in North America, Asia and Europe. The results of the center's research take the form of objects and exhibitions, meals, labs, workshops and publications. For example, center co-founder Cathrine Kramer ran a project to snow strawberry ice cream, taking her cue from the approximately 1,000 rockets that were used to keep the sky clear for the opening ceremony of the 2008 Beijing Olympics.

The Center for Genomic Gastronomy, which promotes a variety of projects that stimulate debates such as this, has mainly gone forward with research about the current state of food on earth. However, recently inspired by the wonderful research regarding the condition of food in outer space, members of the center have attended ESA (European Space Agency) workshops, stepping into new territory. Mr. Denfeld stated that research such as this has put the focus on what is grown on the "farm," including in outer space. This is a reaction to the recent trends of modern reputable chefs and researchers who took the lead in driving molecular gastronomy, scientific analysis in the kitchen (personified by the restaurant El Bulli), as well as farm to plate restaurants firmly stamped with organic and farmer-originated as their style (personified by the restaurant NoMA). Currently, The Center for Genomic Gastronomy is tackling issues from the cosmic scale viewpoint described above to the "problem of taste." By using egg foams, which are 90% air, they perform smog tasting, to test what our environment tastes like. They are also using a tear-drinking moth to research what we taste like. Mr. Denfeld said that points of view such as these are arriving at the vast concepts of Gaian Gastronomy and Permaculture in Outer Space.

—The Center for Genomic Gastronomy is an artists' collective that studies biotechnology and biodiversity surrounding food."

—Expanding on the Problem of Food on a Cosmic Scale, while Adjusting to Trends Following Molecular Gastronomy.

—Gastronomy on Earth and Researching Semi-permanent Agriculture in Outer Space

Ms. Melodie Yashar and Mr. Masayuki Sono are New York-based architectural designers who are respectively co-founders of Space Exploration Architecture and Clouds Architecture Office. The two firms joined forces in 2015 to assemble a team of experts from a wide range of fields to participate in NASA's 3D Printed Habitat Competition for crew of four to live on Mars. Their innovative proposal, Mars Ice House, utilizes ice from below the Martian surface and won the top prize in NASA's competition.

There is abundant ice below the surface of Mars. Though recent findings have proved this to be the case, nobody thought to link the availability of ice with a habitat for humans. While investigating ways to fulfill the competition's requirement to use construction materials indigenous to Mars, the team realized that not only is ice a source of life-sustaining water, but it is also highly effective as a radiation shield, making water-ice mining a necessary and indispensable mission activity for prolonged human habitation on Mars. The result was a brilliant alternative to the conventional approach, which often involves burying the habitat underground and using topsoil (regolith) as a basic building material.

Of the approximately 200 entries in this competition, Ms. Yashar and Mr. Sono's team was the only one to propose creating a habitat out of water-ice. Despite the ingenuity of the concept, the team in fact revealed that at one point they had investigated a variety of topsoil-based habitats. What ultimately brought them back to the unprecedented concept of Mars Ice House was a persistent desire to liberate the inhabitants from a perceptually isolated space. As a result, they arrived at the novel concept of constructing the ice-based structure within the translucent pressure membrane rather than outside of it as conventionally conceived, so that after the appropriate environmental pressure is created, the interior wall can be constructed by means of 3D printing. Moreover, they stated being drawn to the translucency of ice, which allows for the penetration of natural light, as well as its beauty as a building material.

Ms. Yashar and Mr. Sono stated that the team resolved to design the Mars habitat based on design values which we would otherwise employ here on Earth, and would not treat the design differently due to its setting in a foreign environment or its schedule to be built decades in the future. They set their sights not only on functionality, but also on a design that would serve as a landmark for life.

Ms. Yashar and Mr. Sono's team, who stated that NASA's appreciation of their proposal's emphasis on both human factors and technology provided a new understanding of how technologies for space exploration contribute and benefit our world here on earth, are now working with NASA Langley Research Center in the development and design of a related Mars habitat concept.

—The Mars Ice House subverts certain conventions of human habitat design on Mars through its use of both structure and materials.

—Though it may be some time before habitats are constructed on Mars, the occupants will ultimately be human, and therefore the sensibility should be familiar and the values based on human factors.

—The mining of water-ice is a necessary and indispensable mission activity if we are to achieve prolonged human habitation on Mars.

In the discussions, speakers who have launched and are engaged in projects related to space from a variety of standpoints spoke about the significance of human presence and of manned missions in space travel.

Mr. Tom Sachs, who parallels NASA's space development program through handmade imitation, looked back at the negative history traveled by humans by means of entertainment, and described how people aim to connect with each other by presenting old and new worlds as a single structure.

Ms. Melodie Yashar and Mr. Masayuki Sono, who collaborated over the course of a NASA competition and designed an award-winning Mars habitat made of ice, are paving the way for design possibilities in space development to be open to not only engineers but also to designers and architects. They described the excitement of their ongoing work, in which they consider new opportunities for space exploration through collaborative research, innovation, and design.

Mr. Zack Denfeld, who explores food in space, noted that holding dreams about space has a symbolic value in that it creates circumstances and perceptions we could not have foreseen, and thus contains a hidden power. With respect to the questions of why human beings must go to space and why robots cannot go instead, Mr. Denfeld emphasized that culturally we benefit from the return of people who have gone to space. Mr. Sono, too, agreed that new perspectives can be gained by having people, rather than robots, go into space.

In response to Sachs' remark that projects involving space are all "real-world" projects, Mr. Fumio Nanjo said in summary that space, which holds an overwhelming reality while also stimulating the imagination, has an endlessly suggestive presence when the relationship between science, technology, and human beings is considered. Mr. Nanjo continued by noting that, with the involvement of humans, space issues always encompass cultural issues. This brought the panel discussion to a close.

—The scope and ambitions of space architecture have now broadened, with the door open to not only engineers

—The innovative significance of humans themselves visiting space rather than robots

—The significance of space travel, which represents scientific progress and the future of technology for all human beings

SPEAKER

MODERATOR

TOM SACHS
Artist

ZACK DENFELD
Artist / Co-founder, the Center for Genomic Gastronomy / Researcher, Science Gallery, Dublin

MELODIE YASHAR
Architect, Space Exploration Architecture / Assistant Professor, Pratt Institute

MASAYUKI SONO
Co-Founding Partner, Clouds Architecture Office

FUMIO NANJO
Director, Mori Art Museum

ART & CREATIVITY SESSION 2

The Japan Foundation Asia Center Session

"Lifestyles in Asia in the Future"

Ideas from History, Culture, and the Environment

— Despite differences we shared
common values in our cultural heritage

— We enjoyed the George Town Heritage Celebrations
because it is the project belongs to the communities
of George Town

— Cultural heritage is something we identify as important
and wish to pass it to the next generations

George Town on the Malaysian island of Penang, which is about five times bigger than Ueno Park. It was registered as a UNESCO World Heritage Site, along with Malacca, in July 2008 for its unique townscape and outstanding multicultural heritage within the city.

After building a career as a public policy expert in diverse cultures such as Thailand and Sweden, Dr. Ang Ming Chee became General Manager of George Town World Heritage Incorpo-

rated and serves to bridge gaps of policy implementations and community interests on cultural heritage conservation and safeguarding efforts. The tasks to achieve mutual consensus may be challenging but continuous outreach and education efforts have been ongoing through various programs and projects.
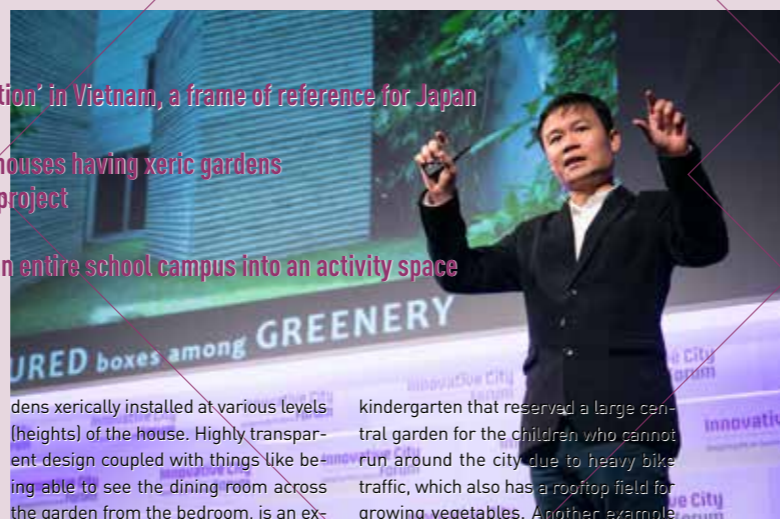
George Town has outstanding tangible heritage properties and unique landscape of intangible cultural heritages. After successfully establishing the George Town Special Area Plan to

manage the tangible elements, it is now focusing on the safeguarding of the intangible heritage. Among the activities conducted is the "George Town Heritage Celebrations" event held every July. Every year it looks at the town with a different theme, that is, looking at the town from a different perspective, rediscovering what kind of people live in George Town, or what the regional identity is. In 2016, with the theme of traditional sports and games, games that use toys no longer in circulation were revived spectacularly during the event with participation by more than 8,000 people.

The feature of this event is in the way that it is held. Dr. Ang stated that while there is diversity in ethnicity, culture and language, people shared the appreciation of wisdom and knowledge from the older generations, and also wish to pass on something good for the next generations. Therefore, Dr. Ang and her team interviewed and communicated with the local communities to identify their cultural elements, to document this important information and to package the elements in an interactive and educative manner for the Heritage Celebrations. To that end, the budget equivalent to 10 million Japanese yen received from the State Gov-

ernment of Penang paid for not only the salaries of 43 participating contract staff such as curators, project coordinator, logistic coordinators, designers and so on, but also to cover the cost for 120 days of preparation work, which included the research, documentation, publicity and logistic arrangements. The event also mobilized some 400 young volunteers who supported implementation of the event on the day. Moreover, by obtaining the cooperation of the local residents, roads are cleared within the heritage area to enable the public to engage in cultural heritage activities at the backdrop of the heritage town.

Regarding the point of cultural heritage conservation, Dr. Ang also addressed the strategies to reach out to broader audiences on cultural heritage matters. This included framing the activities to suit the interest and needs of target audiences according to their age groups and linguistic backgrounds. In particular, the game cards that have been produced from research and interviews with the local community are translated in four languages (Tamil, Chinese, Malay, and English) and these can be downloaded for free from the website. She also stated that measures were implemented to enliven the event, such as distributing stickers to successful players to fuel competitiveness. Finally, she introduced that in 2017 this event, which unearths intangible cultural heritage every year from various angles and preserves it contemporarily, will be held from July 7 to 9.

Vietnam has a population of almost 100 million people and is similar in scale to Japan, including the area and the shape of the country. The representative of the Vietnam-based, internationally active Vo Trong Nghia Architects, Mr.Vo Trong Nghia studied in Japan from his time in technical college, and later under Hiroshi Naito at the University of Tokyo graduate school, returning to his home country in 2006. In order to overcome the overwhelming shortage of greenery in Vietnam's cities, he comes up with solutions through architecture and urban planning.

In Ho Chi Minh City, there are only 0.7 square meters of green space per person. Considering that in Tokyo it is 10.6 square meters and in Singapore it is 60.0 square meters, there is a drastic shortage of greenery in cities, and it seems like a concrete jungle. The numbers of motorcycles and cars are increasing every year, and the living environment worsens. As a result, Vietnam's cities are tormented by pollu-

— Greening through construction' in Vietnam, a frame of reference for Japan

— Innovative ideas to create houses having xeric gardens
in 'Pots for planting trees' project

— Using greenery to change an entire school campus into an activity space

tion, flooding, overheating, and people's subsequent inactiveness.

In response to this situation, Mr. Vo turns the parts of a house into "pots" – he designs green house structures where the roof of a room is assembled from "pots" that have trees planted in them. In tropical areas like Vietnam, both rainfall and the amount of light are ideal, and almost no plant maintenance is required. When constructing one house or one building, he says that it is vital to increase the greenery as much as possible.

He also demonstrates his skills at educational institutions. One example is a

dens xerically installed at various levels (heights) of the house. Highly transparent design coupled with things like being able to see the dining room across the garden from the bedroom, is an example of how the usage is well thought out as one can view the gardens at several levels from the room. In addition, various ways to increase the city's greenery area have been implemented, including the tops of pitched roofs designed like parks and, organically entwined with the surrounding landscape.

He also designs villas that have gar-

kindergarten that reserved a large central garden for the children who cannot run around the city due to heavy bike traffic, which also has a rooftop field for growing vegetables. Another example is a university campus where the whole is designed as a forest, one huge activity space that can be used for walking and sports, as well as studying, of course. In addition, Mr. Vo introduced various building materials made from bamboo.

Mr. Yukinori Yanagi is an artist whose works relativize systems regarding art and are full of humor and criticism. While living in Onomichi, Hiroshima, he currently works on a project that connects the islands of Setouchi Inland Sea and revitalizes buildings there.

Mr. Yanagi, who used to live in New York and gained high critical acclaim there, spoke about having doubts about the booming art market and the complicit relationship between capital and art. He was looking for something in Japan that touched his soul, something that he could call his life work, when he discovered Inujima, located in the eastern Seto Inland Sea. On this small island with a population of about 40 people is a copper smelter, built in the Meiji era. With Japan modernizing to catch up with the West and losing as many things as it gained, this copper smelter was lost as well, finally becoming abandoned in the process. Recently, city dwellers are causing prob-

lems there by bringing in industrial waste. Mr. Yanagi points out how rural areas are being widely exploited in this way, also seen in the relationship between Tokyo and Fukushima where the nuclear accident took place.

This is where Mr. Yanagi created the Inujima Seirensho Art Museum. This building doesn't have a machine room, and runs solely on renewable energy such as air flowing through chimneys. One major exhibition theme is Yukio Mishima, who warned about values that were lost in the postwar economic growth of Japan. Yanagi's piece approaches modern Japan critically by reusing parts of Mishima's house in Shoto, Tokyo. It is suggestive of Icarus from Greek mythology, who fell to earth because he got too close to the sun, reflecting how present day humans are too trusting of technology.

The museum also exhibits other works that can't be held in other museums, such as the "Kosagi Island Bio Isle Pro-

ject" and "Art Base Momoshima". Mr. Yanagi continues to create projects that revitalize marginal islands of the Seto Inland Sea into independent organ-

— A project on the islands of the Seto Inland Sea
revitalizes rural areas while reevaluating
their historical meaning

— Problems of modern day Japan are relativized
by the Inujima Seirensho Art Museum

— Art connects the Setouchi Inland Sea islands

isms that are symbiotic with the environment, and proposes to realize art tourism by sea route.

— When establishing a new project in the city,
how to establish a relationship with historical heritage

— City as a 'living museum'

— Balance required for gentrification

In the panel discussion between Ang Ming Chee, Vo Trong Nghia and Yukinori Yanagi, the topic under discussion was the issue of how, when launching a new project, to make use of the city's pre-existing historical heritage.

Dr. Ang, who is involved in the conservation and management of the George Town UNESCO World Heritage site, pointed out that not only the built structures, but also the people who live and work there and their organic relationships are part of cultural heritage. Safeguarding of both tangible and intangible heritage are equally important in a sustainable management of the world heritage site.

Meanwhile, Mr. Yanagi, who created an art museum based in a Meiji era copper refinery on the island of Inujima in the Seto Inland Sea, stated that rather than the art that is contained within it, the sense of message of the building

itself is important. He also said that the buildings bombed in Hiroshima, as a site unique in the world, will produce a strong message if combined with art.

Mr. Vo, who is engaged in urban architecture in Vietnam, is at the same time aware of the current trend to reconsider the role of the architect themselves, as symbolized by the words to the effect that the architect's job is re-connect the humans and nature in cities where greening is required. In response to these arguments, Ang responded that she believed the whole city is a "living museum", in which the way humans walk, speak, and exist is all an exhibit, and stated that the definition of a museum is also currently being reconsidered.

In the question-and-answer session with the floor, the positive and negative parts of "gentrification" caused by the influx of artists in the city and the revitalization of cultural activities were discussed. Dr. Ang cited examples

where tourists flooded locations with mural paintings and disturb the daily lives of the local residents. Mitigation strategies such as educational programs can be introduced for these tourists on the heritage values surrounding the arts exhibitions. Mr. Vo also touched on the situation in Hoi An, which was designated as a World Heritage Site but where the activities of artists are not continued. Mr. Yanagi

pointed out the difficulty of inviting artists, who seek free expression activities, to one area to make them active. Throughout the discussion, it was confirmed that it was necessary to continue thinking about the relationship between new urban projects, people, and Asia's historical heritage, from the various standpoints of engaging in urban planning, architecture, and art.

MODERATOR

FUMIO NANJO
Director, Mori Art Museum

SPEAKER

ANG MING CHEE
General Manager,
George Town World Heritage
Incorporated

VO TRONG NGHIA
Architect /
Founding Partner,
Vo Trong Nghia Architects

YUKINORI YANAGI
Artist

FUTURE TOKYO SESSION
TOKYO 2035

—Future Tokyo Session imagines the future through brainstorming

—Capturing changes through the broad advancement of technology, from people's feelings to a macroeconomic environment

—Expectations for changes in ways of working represent each participant's awareness of issues

OPENING

MODERATOR

HEIZO TAKENAKA
Professor, Toyo University / Professor Emeritus, Keio University / Chairman, Institute for Urban Strategies, The Mori Memorial Foundation /Director, Academyhills

NAOKI ADACHI
Founder and CEO, Response Ability, Inc.

IZUMI OKOSHI
Head, Dentsu Innovation Institute

KOJI KOIZUMI
Founder & CEO, R.GENE Inc. / Chief Editor, IoT NEWS

HIROO ICHIKAWA
Professor and Dean, Professional Graduate School of Governance Studies, Meiji University / Executive Director, The Mori Memorial Foundation

The Premise of Valuing Imagination Over Knowledge

At the Opening Session of Future Tokyo Session, a new endeavor for the ICF, Mr. Takenaka from the Program Committee served as the moderator. He explained the significance of discussing Tokyo in 2035 through brainstorming, shared the purposes of the 4 breakout sessions, and encouraged the participants to express their ideas freely, quoting Einstein's statement that, "Imagination is more important than knowledge."

For "Future Living," in which the participants consider the lifestyle of Tokyo 20 years from now, Mr. Adachi from Response Ability, Inc. indicated that the purpose of the discussion is to exchange ideas about how day-to-day life will change as a result of advancements in technology and also stated

that he expects the talks to advance toward a philosophical discussion of what people will live for. In addition, he announced that specialists from various fields, such as 3D printing and e-commerce, will participate as speakers.

Next, Ms. Okoshi from the Dentsu Innovation Institute explained the aim of "Future Work," for which the most change was anticipated in the survey prior to the session. Ms. Okoshi raised the keywords of artificial intelligence and robotics, keywords about which many lectures were held during ICF2016, and posed a request to discuss a society in which AI coexists with humans. Also, while touching on the fact that 2 people from companies offering crowdsourcing, a new way of working, will participate as speakers,

she spoke about the necessity to capture the economic impact of new ways of working from a macroeconomic perspective.

Mr. Koizumi from R.GENE Inc. announced that during the "Future Mobility" breakout session, he would like to deepen the discussion about mobility in Tokyo in 2035 through examining case studies, such as the rapidly advancing autonomous vehicles. He stated that although this field is frequently covered in media, he would like to speak with the speakers, who have accumulated practice and knowledge in their fields of specialty, about how life will change in the city and for each individual person through changes in mobility.

Finally, Mr. Ichikawa, a member of the

Program Committee and the facilitator of this breakout session introduced "Future Entertainment." Because entertainment is a broad concept, Mr. Ichikawa stated that the discussion will be broken into the 4 categories of 1) indoor entertainment represented by household gaming devices, 2) outdoor entertainment represented by movies, 3) shopping centers as complex facilities, and 4) outdoor entertainment in public spaces. Within this framework, he spoke of his desire to investigate universal humanity by thinking back about the past while imagining the future to examine whether people's feelings have changed from the past and if these feelings change when the environment changes.

FUTURE LIVING

—The arrival of consumer involvement in mass customization of products

—A future where rather than economic value, emphasis is placed on the community value of shared sensibility?

—Designing a society that allows for diversity of lifestyles, including views on life and death

A Society of Diversified Lifestyles Requires Diversity from Individuals

In this session, moderated by Mr. Adachi, who has been working on biodiversity issues through collaboration with leading companies, an active debate was held on human life and the way we live it, and how the progress of technology and the changing environment are re-defining these ideas.

Rakuten Inc. executive officer Mr. Ichihara, who has been observing changes in people's lives due to the infrastructure of the Internet, looked at the future of personalization in e-commerce. He suggested that as the act of buying and owning things is replaced by sharing and we reconsider the way of "owning", and with the producer, seller and consumer in constant communication, this is coming into view as the consumers themselves ultimately shaping what they want. There will also be a rush to build a platform on which to live out such a new consumer life.

Mr. Katayama, President and CEO of Stratasys Japan Co., Ltd., which is promoting the spread of 3D printers on a global scale, also pointed out the current situation where mass production is tending to reach its limits. He added that the future will be an era of mass customization, and that it is possible to imagine a truly personal situation in which a 3D printer is introduced in each home within a span of about twenty years.

Mr. Maru, CEO of Leave a Nest Co., Ltd., who has advocated a "knowledge manufacturing industry" and promoted corporate innovation in cooperation with industry and academia, and based on his own experience of the research group at his own company, also referred to the state of a future society that lies ahead of personalization. Mr. Maru, who said that many fanatical communities may appear in which people build networks depending on each individual's sensibilities and intentions, stated that a paradigm shift will occur at the center of our lifestyles away from a vector of economic value to a vector of community value.

However, even in a future society where transformations take place in all ways of working, it can be expected that people will exist who are not necessarily creatively oriented. Each person has a different way of living and embracing a sense of fulfillment and feelings of happiness, and how to think about the way in which society faces such diverse vectors became the topic of debate. The

problem of how to think about the diversity of people's lives, including the way in which the boundary between the producer and the consumer is dissolved, leading to a "prosumer", as presented by Mr. Adachi, was the subject of many exchanges of opinions and became an important issue raised by this session.

Also, when looking ahead to 2035, it is expected that healthy life expectancy will also increase with the development of medical care, including bioprinting. At that time, the agenda that various values will come to exist, related not only to the way of living but also the way of dying, was discussed from the viewpoint of lifestyle. On the other hand, concerns were also presented about the peer pressure on Japanese society that could impede such innovative progress, leading to the conclusion that what is to be hoped for is a future that can address the lifestyle innovation that is sure to come and the issues that it brings.

FACILITATOR & RESOURCE PERSON

NAOKI ADACHI
Founder and CEO, Response Ability, Inc.

HIROAKI KATAYAMA
President & CEO, Stratasys Japan

YUKIHIRO MARU
President and CEO, Leave a Nest Co., Ltd.

KEISUKE ICHIHARA
Executive Officer, Rakuten, Inc.

FUTURE WORK

—An end to the distinction between regular and non-regular employment,
an emergence of "new collar" jobs & new classes

—"Rarity" of the individual worker's skill set to be sought
after as technology takes over and the role of the enterprise diminishes

—Systems to be built that support yet unknown occupations,
and individuals to take on increased responsibility as they gain freedom

The Industrial Revolution in 200 Years Trigger Transformation of Social Structures

Under the facilitation of Ms. Izumi Okoshi, head of innovative social solution provider Dentsu Innovation Institute, a discussion coupling theoretical analysis with specific ideas based on real practices unfolded among researchers and businesspeople alike who gathered to talk about how people will work in the future and what the function of the enterprise will be.

The first topic discussed the disappearance of the distinction between "regular" and "non-regular" employment. Waseda Business School professor Mr. Negoro characterized the likely future to be one where the concept of non-regular employment has disappeared over the long term, but not one where all workers are freelancers— instead, where individuals work when they want and where they want in a "temporary affiliation" type of relationship. Mr. Yoshida, CEO and founder of Crowd-Works Inc, pointed out that at the time of the Industrial Revolution in 1810, blue collar workers who feared job losses by the advent of machines triggered the Luddite movement. Similarly, he predicted that now some two hundred years later the introduction of AI to white collar work would create a "new collar" type of job. Mr. Minami CEO of Coconala Inc. which operates a C2C platform expressed his opinion that a new class of worker would emerge in the future where individuals would work selectively and make their own judgments about every aspect of their work.

What changes could then be anticipated in the shape or function of the enterprise? Mr. Negoro stated that enterprises would be needed to hold onto capital and drive forward major projects, and that the role of the enterprise as an agent of or party to contracts

would survive. He explained the background by mentioning that as enterprises outsource work by project, lower communication costs for joint ownership of context would give people more freedom to operate, and those possessing some kind of "rarity" would become more valued. In this scenario, the enterprise would take on contract issues that could not be taken on by an individual.

Mr. Yoshida emphasized that in a time when robots and AI are coming to prominence, the rarity sought of working humans is related to the ability to do non-linear and/or discontinuous work. The abilities to create grand design type plans and to set agendas for things that do not currently exist will influence the shape of work going forward. Mr. Minami predicted that work to which an asymmetry of information is central would be the kind of work replaced by technology. This would not be a limited number of occupations, but would also mean the elimination of functions in a company where a job learned from a superior is communicated to a junior. A lively discussion including question & answer session ensued, positing a future where people that think for themselves and employ trial and error thinking will be valued.

As Ms. Okoshi pointed out, there still remains the question of how an individual is to be empowered in an unforgiving environment of individual accountability that will accompany individual freedom. Development of a framework to help define new occupations that are not yet clear was also proposed, and the session was concluded with a reminder to the audience of the potentials and challenges alike of the next twenty years.

FACILITATOR & RESOURCE PERSON

IZUMI OKOSHI
Head,
Dentsu Innovation Institute

AKIYUKI MINAMI
CEO/Co-Founder,
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TATSUYUKI NEGORO
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Research Institute of Information Technology
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KOICHIRO YOSHIDA
CEO / Founder,
CrowdWorks Inc.

FACILITATOR & RESOURCE PERSON

KOJI KOIZUMI
Founder & CEO,
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IoT NEWS

TSUGUO NOBE
Chief Advanced Service Architect
and Director, Intel Corp /
Visiting Associate Professor,
Nagoya University

HISASHI TANIGUCHI
President & CEO,
ZMP Inc.

GENKI KANAYA
President and CEO,
akippa Inc.

Competition and Coordination Among Companies form Mobility in Tokyo

The session was facilitated by Mr. Koizumi, who serves as the CEO of R. GENE Inc. and is the Chief Editor of IoT News. The discussion focused on how trends in autonomous vehicles and the sharing economy will change future mobility, and how these changes in mobility will in turn affect our cities and our lifestyles.

Mr. Nobe serves as the Chief Advanced Service Architect and Director for the Intel Corp., which is currently pursuing technologies to computerize cars in order to develop autonomous vehicles. He offered his perspective as a computer technology specialist on a future where cars will operate as mobile computer terminals connected to a data server. In response, Mr. Taniguchi, who is the President and CEO of ZMP Inc. and has overseen demonstration trials of services such as robot taxis, and Mr. Kanaya, who is the President and CEO of the peer-to-peer parking lot sharing service akippa Inc., energized the discussion with their focus on mobility-related services.

The bulk of the discussion dealt with themes such as at what level human drivers should monitor safety, technical challenges that arise when responding to problems that occur during the

switch to automated driving, and the relationship of these technologies to the urban environment. There is a significant difference between Level 3, where a human driver must occasionally manage an essentially autonomous vehicle (i.e. the driver retains some liability), and Level 4, which is complete automation. In the discussion between Mr. Nobe and Mr. Taniguchi, the two affirmed the need not just for competition between companies to develop new technologies but also for data sharing as well. In other words, there is a need for a shared server to accumulate map data and 3D spatial information on which deep learning algorithms can be trained. The ability of autonomous vehicles operating as computer terminals to download information from a centralized data source, and to execute local decision-making while linking with the server, will help smoothly address problems such as traffic jams. Mr. Kanaya, who works face to face with these problems, touched on the potential for a service that could break up the vast parking spaces currently required for large-scale facilities such as stadiums and theme parks into numerous small lots.

Finally, the discussion also raised the challenge of tackling so-called "last

mile mobility," which deals with situations such as transit from a station to a residence, and the unloading or manual transport of goods from delivery trucks. New developments such as the ability for autonomous vehicles to pick up children from a childcare facility and take them to a station for the commute home, or for drones to transport goods from a delivery truck to each house, are expected in the future. There are undoubtedly some concerns pertaining to the adaptation of autonomous vehicles to the urban environment including the speed limit issue and the larger problem of how to phase in the technology at a time when people are unfamiliar with it—in other words whether to begin implementation in rural areas where there are relatively few people and move into the cities, or whether it is necessary to create special zones for intensive testing. Despite these concerns however, this session highlighted the ways in which future changes in mobility will drive substantial innovations in our daily lives.

FUTURE MOBILITY

—The development of autonomous vehicles and progress
in the sharing economy will transform urban centers

—The success of autonomous vehicles requires big data,
which necessitates cooperation beyond the scale of individual companies

—'Last mile mobility' is necessary to support people's
fine-scale movements

FACILITATOR & RESOURCE PERSON

HIDEKI KASAI
Manager,
PPP Business Department,
Technological Business
Development Division,
Obayashi Corporation

TATSURO SASAKI
President,
Sasaki Architects
and Associates

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Professor,
the University of Tokyo,
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HIROAKI KITANO
President and CEO,
Sony Computer Science
Laboratories, Inc.

HIROO ICHIKAWA
Professor and Dean, Professional Graduate School
of Governance Studies, Meiji University /
Executive Director, The Mori Memorial Foundation

FUTURE ENTERTAINMENT

Both Physical Space and Virtual Space Exist in Tokyo, The City of Entertainment

The evolution of indoor entertainment through the evolution of gaming devices. Also, the advancement of movies as outdoor entertainment and the transformation of shopping centers, which now function as complex recreational facilities. Further, entertainment in city spaces, which is rising suddenly due to projection mapping. This session was carried out based on these 4 points presented by Mr. Ichikawa, Executive Director of the Mori Memorial Foundation and Professor and Dean of the Professional Graduate School of Governance Studies at Meiji University.

Mr. Hirose, Professor of the Graduate School of Information Science and Technology at the University of Tokyo, pointed out that for both movies, which still hold power as a branch of mass media, and gaming devices, interactivity between users or clients will be sought through the advancement of VR and AR technology. Mr. Kitano, President and CEO of Sony Computer Science Laboratories, Inc., also focused on the conversion of social media into en-

tertainment through interactivity, and commented on the birth of active users through the real world turning into a gaming world.

On another front, stimulating arguments were also presented by architects, who govern the city's hardware. Mr. Sasaki, President of Sasaki Architects and Associates, focused on the roadside theater implemented in Tsuruoka, Yamagata. He states that we approach an age in which an entire city can be likened to a shopping mall by

pulling out the entertainment that has been tucked deep inside buildings, as symbolized by television, in order to create previously unknown points of contact within cities. Also, Mr. Kasai, Manager of the PPP Business Department of the Technological Business Development Division at Obayashi Corporation, emphasized the necessity of complex perspectives that include environmental issues, which are necessary when assessing city entertainment from an architectural point of view, and brought up the redevelopment of spaces near water as a specific example. The "Smart Water City Tokyo" construction concept announced by Obayashi Corporation in November 2015 proposes rainwater storage facilities built 50m underground, an artificial island built in the Tokyo Bay to anchor large cruise ships, and the conversion of canals and channel networks, which receded into the city's background after the previous Tokyo Olympics, into activity spaces through maintenance and reconstruction that considers the landscape and water amenity.

Despite the fact that these waterfront spaces flourished for transportation in the past, they became spaces that tend to be ignored after the development of the city for the 1964 Tokyo Olympics. However, Mr. Ichikawa used multiple case studies to explain the current situation, in which the latent entertainment potential of real spaces is paradoxically gaining attention through the rapid evolution of technology, with virtual technology leading the way. Finally, Mr. Sasaki pointed out the importance of biodiversity, which includes biological diversity, in addition to the importance of entertainment diversity, to conclude the session.

— The evolution of technology leading to a commitment to interactivity

— The advancement of the conversion of city spaces into entertainment

— Tokyo's possibilities will be opened when it is redesigned as an ecosystem

NAOKI ADACHI
Founder and CEO,
Response Ability, Inc.

IZUMI OKOSHI
Head,
Dentsu Innovation Institute

KOJI KOIZUMI
Founder & CEO,
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HIROO ICHIKAWA
Professor and Dean, Professional Graduate School
of Governance Studies, Meiji University /
Executive Director, The Mori Memorial Foundation

MODERATOR

HEIZO TAKENAKA
Professor, Toyo University / Professor Emeritus,
Keio University / Chairman,
Institute for Urban Strategies,
The Mori Memorial Foundation /Director, Academyhills

WRAP UP

Value Creation Through Technology is Important in the Competitiveness of Tokyo

As the Future Tokyo Session was comprised of four breakout sessions being held simultaneously, the wrap-up session began by each facilitator sharing the details of what was discussed during their respective sessions. The facilitators fielded questions from Mr. Takenaka of the program committee – who served as the wrap-up session moderator – and the assembled audience, further heightening the discussion to envision the Tokyo of 2035.
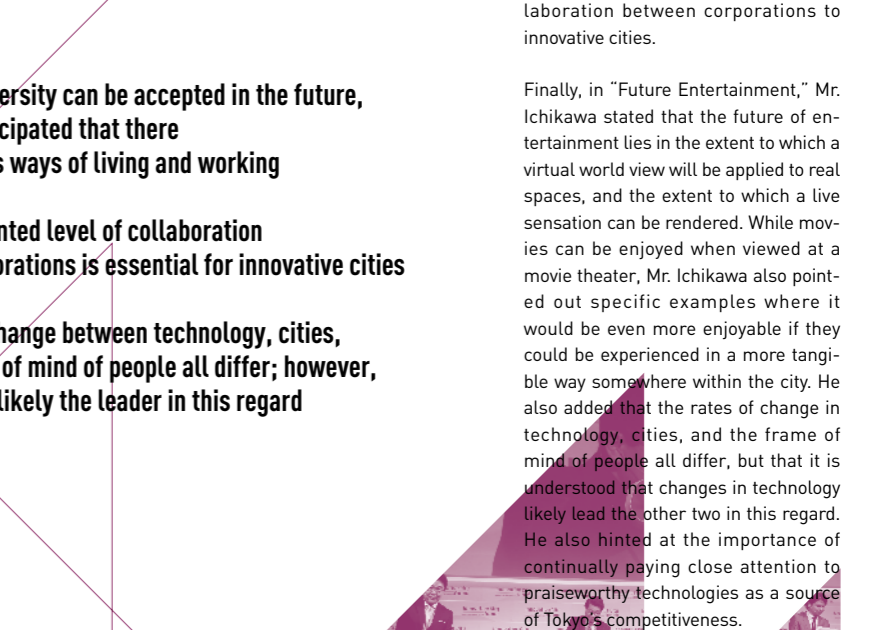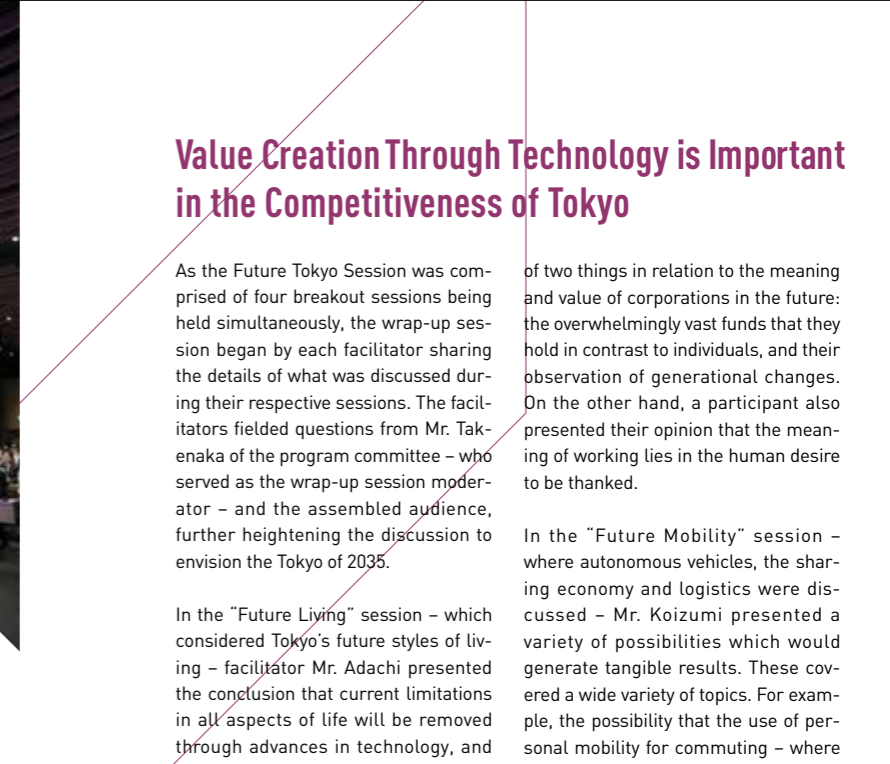
In the "Future Living" session – which considered Tokyo's future styles of living – facilitator Mr. Adachi presented the conclusion that current limitations in all aspects of life will be removed through advances in technology, and that we must strive for a society that can accept diversity in order to accommodate the differing lifestyles that people will lead in 2035. These statements inspired a question from a member of the audience, who inquired about the value of living in Tokyo in 2035. Mr. Adachi replied that since the necessity to live in Tokyo will be reduced, there will be a need for innovation that enables Tokyo to display its uniqueness as a city. Mr. Takenaka also remarked that it would be essential to deliberate on the concept of housing, which changed dramatically during the Meiji Restoration.

Next, in "Future Work" Ms. Okoshi presented that a common understanding exists which says that artificial intelligence and robots will take over routine and linear work tasks, leaving only non-sequential and nonlinear tasks and causing a complete overhaul of the white-collar style of working. Ms. Okoshi also explained the importance

of two things in relation to the meaning and value of corporations in the future: the overwhelmingly vast funds that they hold in contrast to individuals, and their observation of generational changes. On the other hand, a participant also presented their opinion that the meaning of working lies in the human desire to be thanked.

In the "Future Mobility" session – where autonomous vehicles, the sharing economy and logistics were discussed – Mr. Koizumi presented a variety of possibilities which would generate tangible results. These covered a wide variety of topics. For example, the possibility that the use of personal mobility for commuting – where each individual has a different destination – might reduce congestion during commuting hours, and the possibility of the sudden emergence of a society of fully autonomous driving, as malfunctions are predicted in the case of driving that involves cooperation between humans and robots. On the other hand, Mr. Koizumi highlighted as a major issue the culture within Japan which dictates that where no law governs a given matter, nothing can be attempted. He compared this to Western countries, where legislation is introduced in the event that new innovations give rise to problems. Mr. Koizumi stated that from a technological viewpoint, it would be possible to achieve some things by 2020, not to mention 2035. Responding to a question from a member of the audience inquiring about the types of infrastructure cities will develop as a result of the growth of the sharing economy, Mr. Koizumi replied that car manufacturers and information service providers will need to engage in partnerships with their fellow industry rivals, stressing the importance of collaboration between corporations to innovative cities.

Finally, in "Future Entertainment," Mr. Ichikawa stated that the future of entertainment lies in the extent to which a virtual world view will be applied to real spaces, and the extent to which a live sensation can be rendered. While movies can be enjoyed when viewed at a movie theater, Mr. Ichikawa also pointed out specific examples where it would be even more enjoyable if they could be experienced in a more tangible way somewhere within the city. He also added that the rates of change in technology, cities, and the frame of mind of people all differ, but that it is understood that changes in technology likely lead the other two in this regard. He also hinted at the importance of continually paying close attention to praiseworthy technologies as a source of Tokyo's competitiveness.

— How much diversity can be accepted in the future, when it is anticipated that there will be various ways of living and working

— An unprecedented level of collaboration between corporations is essential for innovative cities

— The rates of change between technology, cities, and the frame of mind of people all differ; however, technology is likely the leader in this regard

SPECIAL SESSION

"Second Brain for the Smart City 2: Holobiont Urbanism"

—In smart cities, in which the city itself becomes intelligent thanks
 to advanced technology, it is entities that are invisible to us,
 such as microorganisms, that carry the load of the city's intelligence

—Through genetic analysis of the sediment deposited at the bases
 of beehives found in cities, it is possible to understand
 the genetic characteristics of the surrounding environment;
 that is, the things that live in the city

—The perspective of the holobiont—a community that includes
 all of the living things found there
 —is essential to the concept of the smart city

The City's Identity is Reflected in the Details of Invisible Things

When Mr. Kevin Slavin, Assistant Professor of Media Arts and Sciences at the MIT Media Lab, thought about the future of smart city design, he asked about the importance of a "second brain" for understanding the existence of the unseen within the city. In addition to the things we can recognize, such as buildings, the city is also home to seemingly invisible entities that are much like the characters from Pokemon Go or Moyasimon. Noting that research had been carried out regarding metagenomics as a method for viewing this sort of invisible world, Mr. Slavin explained that collecting fragments of living DNA from urban environments and reconstructing that DNA is a way to clarify the true nature of the things that exist in the city.

Specifically, Mr. Slavin noted that this could be achieved through genetic analysis of the various substances that bees collect. With the use of a "metagenomics beehive," which has been optimized to collect substances (including microbes) from the surrounding environment, a portrait of the city's genetic information, which acts as a sort of fingerprint of the city, is reconstructed. Using the behavior of bees, which do not fly beyond 1-2 miles from the hive, projects of this type have thus far been carried out in Brooklyn, Sydney, Melbourne, Venice, and Tokyo. Plans are being made to convert this information into visualiza-

tions, in order to help us better understand the invisible world that surrounds us. With regard to ideas about the smart city, Mr. Slavin highlighted his inquiry into the "cultural imagination" surrounding the invisible world.

For example, when we look at a sloth, we are actually looking simultaneously at the fungi, insects, and moss that coexist on the sloth's skin as well, notes Mr. Slavin. Then, while pointing to the concept of the "holobiont," which describes a community that encompasses all of the living things within its space, Mr. Slavin emphasized that the identity of a city, much like the identity of a living thing, is more than just what is visible to the eye. As Mr. Slavin puts it, when planning the smart cities of the future, we must consider aspects such as the definition of a smart city, for whom a smart city exists, what about the city is smart, and where that "smartness" comes from. Inviting the audience to take up the task, Mr. Slavin said that the key would be whether we could think about cities as including all living things, and whether we could think about living things on a scale and at a resolution suited to the purpose at hand.

Reconsidering our Coexistence with Microorganisms for Proper Sanitation and Health in the City

Larry Weiss, M.D., is chief medical officer at AOBiome, a biotech startup. He gave a presentation on a bacterium that his company is working with, Nitrosomonas europaea, which oxidizes ammonia and produces nitrous acid, an oxide of nitrogen. This bacterium, which lived in the bodies of our ancestors, is found throughout the natural world. But because it is vulnerable to substances such as soap, it is no longer present on the skin surface in modern people.

Mr. Weiss argued, however, that such bacteria essentially constitute a micro-

biome (microbial flora) that is indispensable for healthy skin. He offered the hypothesis that it is because modern people reject the fact that human beings live within a microbiome, and instead attempt to eliminate such bacteria by means of hygiene, that modern people are afflicted by inflammations, etc., throughout the body. Mr. Weiss stated that such bacteria, just like the kidneys or the liver, constitute a bodily organ that is both our oldest and newest organ, adding that currently research into microbiomes is the field that is receiving the greatest amount of attention in the world of science.

What, then, is the skin microbiome on a healthy human being? Mr. Weiss presented examples of studies that have been reported from around the world regarding tribes that have had no contact with civilization. He explained that the members of the Yanomami tribe, in the Amazon, have Nitrosomonas europaea firmly established in their skin and stomach, and that their skin keeps itself beautiful. He also said that it has been found that hunter-gatherer tribes in Peru and New Guinea have no acne whatsoever. Based on such examples, Mr. Weiss urged that new consideration be given to the situation of modern

people, who are afflicted by inflammatory diseases. While not suggesting by any means that we return to a hunter-gatherer lifestyle, he said that we should modify our understanding of what constitutes "health," and consider how such information should be obtained and put to use by those living in the modern world.

In a test conducted by Mr. Weiss, subjects were sprayed with Nitrosomonas europaea, and the result was that the subjects experienced a decline in the number of illness-related bacteria that they had. He said that as a result of this, he is now working on the development and sale of cosmetics and of cleansing liquids and shampoos that do not kill bacteria. He stated that we should create the concept of healthy bacterial infection, and should rethink our ideas about human beings, looking at them not as something akin to "nouns" but rather as something like "verbs" within a large, complex process. He called for things to be considered from a biological point of view when designing the city of the future.

—The bacteria that traditionally coexisted on the human skin have been lost,
 so people of today suffer from inflammations.

—Tribes that have had no contact with civilization have kept these bacteria,
 and their skin is beautiful. We need to redefine what is meant by 'health.'

—In designing the cities of the future, we need
 to evaluate healthy bacterial infection and look upon human
 beings as situated within 'verb'-like biological processes.

SPEAKER

KEVIN SLAVIN
Assistant Professor,
Media Arts and Sciences, MIT Media Lab

LARRY WEISS
Chief Medical Officer, AOBiome LLC

MASAYUKI ISHIKAWA
Japanese Manga Artist

ELIZABETH HÉNAFF
Weill Cornell Medical College Postdoctal Researcher

Cities Must Recognize the Existence of Microorganisms Through the Lens of Both Culture & Science

A session was held featuring Mr. Kevin Slavin, who is collecting and analyzing DNA in urban environments using beehives, Mr. Larry Weiss, who is re-examining the original human skin microbiome (microflora), Mr. Masayuki Ishikawa, creator of the popular comic book 'Moyashimon' about an agricultural university student who can see bacteria, and Ms. Elizabeth Henaff, who is exploring computational biology at Weill Cornell Graduate School of Medical Sciences in New York, in which the participants exchanged opinions on the theme of the "invisible world" and its importance in urban design.

Mr. Ishikawa introduced an episode about the time that he visited a sake manufacturer while trying to depict the department of brewing and fermentation at the agricultural university. His attention was caught by an expression that the employee in charge used regarding the sound made by the yeast fermenting in the tank, which they described as "listening to the 'voice' of the yeast". He looked back to the idea that if you could hear their voice, it would be good if people could see their form and if the bacteria could speak, and how this idea became the origin of his work.
Mr. Slavin agreed with Mr. Ishikawa 's

perspective of focusing on the voice of something whose existence is unknown, and he continued that the scientists who explore life don't actually know the true identity of the majority of the things they study. Mr. Weiss responded that they are standing at the exciting "entrance" to a world of complex and enormous research subjects. Ms. Henaff, who is involved in a lot of projects such as exploring the microorganisms that inhabit subway stations around the world, said that the paradigm of human-based microbial research has shifted and, just like in the world of Moyashimon, we are beginning to move towards imagining and exploring the abundant "invisible world" that is all around us.

Ms. Henaff raised the question of whether, in designing the architectural environment of the city and examining

building materials, we can have a positive impact on microorganisms, saying that microorganisms have developed genetic pathways that break down harmful substances due to the contamination originating from industries that mankind has developed. Dr. Weiss also asked for environmental design that establishes microorganisms whose coexistence promotes "health". Mr. Ishikawa stated, with respect to Moyashimon, that when referencing the results of researchers who are constantly exploring unknown fields, his work may be influenced by that "air of tension", while Mr. Slavin expressed his hope that just such a representation of the "invisible world" would lead to dissemination of the correct way of thinking about microorganisms, as it is necessary for both science and culture to advance. This brought the session to a close.

—Urban design is needed that positively influences
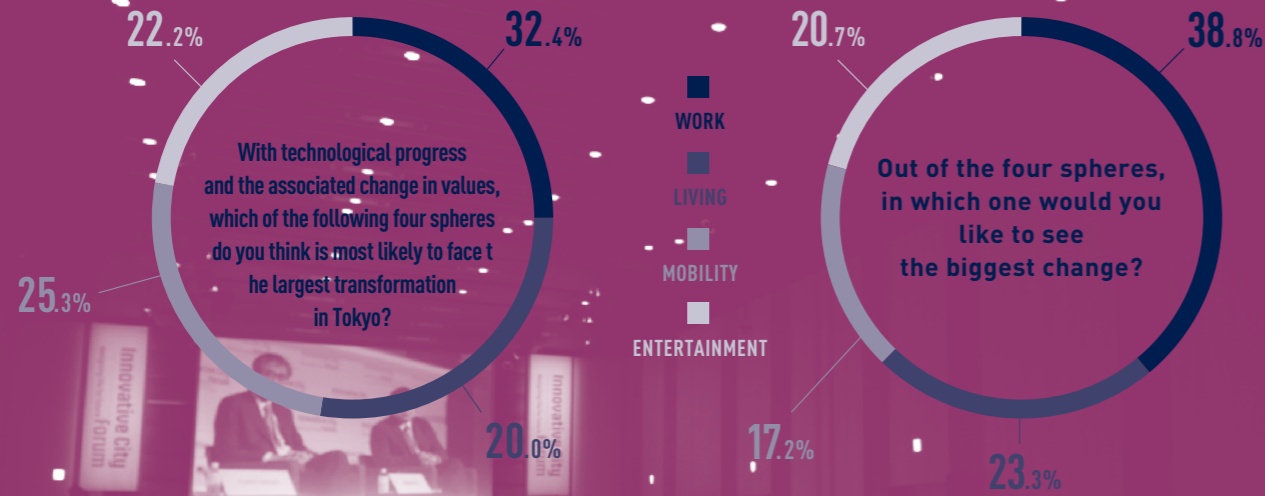 microorganisms and allows them to coexist with humans

—A dialog between scientists at the beginning of the unknown world,
 and the "invisible world" depicted in 'Moyashimon'

—The paradigm shift concerning unknown organisms
 should advance both science and culture

CLOSING SESSION

[Cosing session questionnaire result]

22.2% **32.4%**

25.3%

With technological progress and the associated change in values, which of the following four spheres do you think is most likely to face the largest transformation in Tokyo?

20.0%

WORK

LIVING

MOBILITY

ENTERTAINMENT

20.7% **38.8%**

Out of the four spheres, in which one would you like to see the biggest change?

17.2% **23.3%**

In the panel discussion of the closing session, program coordinators Mr. Heizo Takenaka, Mr. Hiroo Ichikawa, Mr. Fumio Nanjo, and Mr. Joichi Ito shared what impacted them strongly at this Innovative City Forum.

Mr. Nanjo gave as an example of how 1960s Metabolism architecture realized using current technologies and how such architecture would greatly affect cities in the future profoundly im-

pressed him in the talks. Furthermore, he related that it was good that each industry or field could have a concrete and realizable image of what was discussed in the subcommittee discussions which were formed to generate new approaches. By looking at what they have in common, society will change to become an entity optimized for individuals, thus greatly changing how people live their lives, he said. With regards to that, Mr. Ito gave an ex-

ample from the AI panel discussion which he headed. He mentioned that while discussing details made visualization possible, the complexity of the problem was such that it could not be completed by one company operating in isolation or by one single government initiative; general discussions also did not reach the materialization stage. In other words, he got the impression that it was unclear on the direction of efforts going forward and who was having ownership of these efforts. Also, using the U.S. where he lives and works as an example, he talked about the relationship between politics and urban economies there and raised the question of whether it was time for Japan to consider a democratic way of government; he mentioned that the Tokyo Olympics would be an opportunity to test that hypothesis.

To reiterate the multiple functions of cities, each of the panelists described the future need for discussion from the viewpoints of politics, medicine, and immigration. Furthermore, discussion

proceeded on the final agenda item, i.e. the metropolitan areas strategy for Tokyo in the future.

Mr. Nanjo opined that it was high time that new ideas be generated concerning Tokyo, because it has a shorter history compared to Kyoto or Nara. He reiterated that ideas should not be monopolized any longer, but instead shared so that Tokyo could become the best city in the world through collaboration with other cities.

Mr. Ichikawa pointed out that according to surveys on people's perception of Tokyo showed that people who visited Tokyo thought that "Tokyo is clean, high-tech, and is a superb example of how a city should be", while people who had never visited Tokyo thought that it was "dirty and crowded": two contrasting opinions. He indicated that urban management knowhow and concepts practiced in Tokyo and so well regarded by other countries needed to be brought to a higher level.

Mr. Ito also said that existing city creation based on top-down and effectiveness indexes should be scrapped, and that Tokyo should instead carry out efforts based on the fact that ideas which are interesting will gain worldwide attention, be imitated and eventually spread like wildfire. He added that a critical mass of creative individuals would be needed along with the presence of rules and regulations.

Finally, Mr. Takenaka touched on the need for Tokyo to be world-renowned for being an interesting city and confirmed the importance of staying relevant in a global context.

—Urban design is needed that positively influences microorganisms and allows them to coexist with humans

—A dialog between scientists at the beginning of the unknown world, and the "invisible world" depicted in 'Moyashimon'

—The paradigm shift concerning unknown organisms should advance both science and culture

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