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FEATURE

To Be the First in the World

To engage in a fierce competition to make new discoveries. This is also part of being a scientist. With his research on polymers, Yokozawa put one of these competitions to rest. In doing so he overturned the conventional wisdom in chemistry. Here he was like a runner in a winner-takes-all race for the truth.

Professor

Tsutomu Yokozawa

Faculty of Engineering
Department of Material and Life Chemistry

Synthetic Polymer Chemistry

Monomers and Polymers

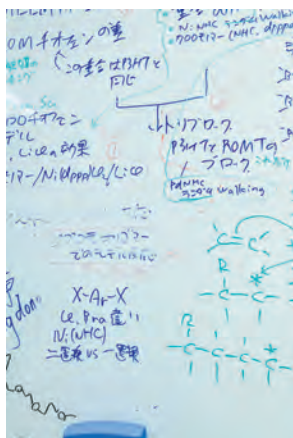
"The order is important. You really need to be first," says Yokozawa, explaining that for a scientist glory is given to the first to make a new discovery. As someone who has been showered in this glory, he should know. What Yokozawa discovered before anyone in the world was a new way of making polymers (organic compounds of macromolecules; artificial polymers include things like plastics and synthetic fibers). More precisely, he discovered a method of controlling how molecules come together that allows for the accurate synthesis of polymers with the desired amount of molecules. "We call the small molecules that become polymers 'monomers,' and connecting lots of these monomers to make them longer 'polymerization.' This way of connecting (polymerizing) can be broadly divided into two methods depending on the type of molecule: step-growth polymerization and chain-growth polymerization. One form of step-growth polymerization is polycondensation, (also called 'condensation polymerization') in which monomers combine into polymers by eliminating water or alcohol. This is used for things like nylon and the PET in plastic PET bottles. In the other type, chain-growth polymerization, a catalyst called an 'initiator' is used to link monomers one after another into a longer and longer chain, resulting in polymerization in a chain reaction manner." To give a slightly crude example, if one LEGO brick were a monomer, a combination of thousands or tens of thousands of bricks would be a polymer.

In polycondensation, the process of combination is random and left up to the individual monomers. As a result it is impossible to precisely control how long the polymer will get, and you end up with irregular polymers with variously molecular weight.

When you conduct chain-growth polymerization with the living polymerization method, on the

Tsutomu Yokozawa

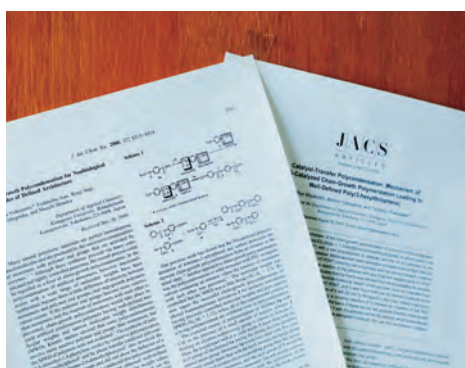
Born in Chiba Prefecture in 1957. Left part way through a doctoral program in chemical technology at the Graduate School of Engineering of the Tokyo Institute of Technology in 1985. Received a Ph. D. in engineering (Tokyo Institute of Technology) in 1987. Became an assistant professor in the Tokyo Institute of Technology's Research Laboratory of Resources Utilization in 1988. Became a full-time lecturer in the Department of Applied Chemistry (Department of Material and Life Chemistry) at Kanagawa University's Faculty of Engineering in 1991, where he is now a professor. His research field is synthetic organic chemistry and synthetic polymer chemistry.



A mess of chemical formulas cover the whiteboard in the laboratory.



A device for purifying polymers Yokozawa has been using for more than twenty years. The nature of reactions can be determined by separately analyzing those high- and low-molecular-weight molecules.



Yokozawa's paper that garnered international acclaim after it was published in the *Journal of the American Chemical Society* (JACS) in 2000.

other hand, you can create a polymer with a defined molecule weight depending on the amount of initiator used. In other words, it is possible to flexibly and precisely control the molecular weight. "The problem is that you cannot use this living polymerization method with the type of molecules that undergo polycondensation. 'You cannot control the molecular weight in polycondensation' is even written in textbooks."

Recreating What Happens inside the Body of a Living Organism in a Test Tube

This is not the case in the natural world. "Proteins and DNA are polymers synthesized by polycondensation. Nonetheless, they are synthesized with good control and to a specific length. They are essential to life, so it be a problem if they came out wrong. So why is it that something we cannot do in a test tube can be done inside the body of a living creature? I wanted to see if I could replicate what was happening inside these living bodies in an artificial environment."

If this could be done the textbooks would have to be rewritten. Just attempting this was ambitious, difficult, and in a sense reckless. But Yokozawa and the students in his laboratory kept at this challenge without backing down. "I realized that if I could make it so that monomers only reacted with the propagating end of a macromolecule, then I would be able to synthesize molecules with specific lengths determined by the quantity of the initiator. But how could this be done? I tried various approaches, and for seven years after beginning this research I didn't obtain any significant data."

Eventually Yokozawa hit upon a method using something called the "substituent effect." He immediately wrote it up in a paper and released it in Japan. He had only experimented using a virtual model and hadn't actually synthesized a polymer using this method, but his paper nevertheless garnered a large response. This was in 1996.

"What happened as a result of this was that rivals emerged who began doing similar research. This focused us even more intently on what we were doing, and made us work even faster."

Even during the year he spent doing research in America from August of 1997, Yokozawa remained in close contact with his laboratory at Kanawaga

University through fax and email, and did not let up in his efforts. Rumors reached him that a "leading scientist" had succeeded in living polymerization of polycondensation. When he sent a student to the briefing it seemed the rumor was true, and the report came back, "We've failed." Yokozawa was shocked. "Why had we lost? What was the reason? And if we were going to begin a counterattack, where should this blow be aimed? I focused all my attention on this and kept thinking. In effect this may have been a good thing. Later we learned that the reports of success by a prominent scientist were in error. We were still in the lead."

A Happenstance Miracle

One day when conducting experiments as usual, a student thought he had failed again and was about to discard the contents of the test tube. "Having gone to all this trouble I might as well measure the molecular weight," he thought. Usually they get well-defined polymer with molecular weight of no more than 5,000, but when he measured this sample he found the molecular weight reached 10,000 in precisely controlled manner. They had succeeded. Living polymerization had occurred in polycondensation.

"We've finally done it! We were all overjoyed. We'd succeeded by chance, so we developed a theory of why it had worked, gathered the data we needed through experiments, and when we were ready I gave an oral presentation in the national meeting of the American Chemical Society. As it turned out my time slot was four in the afternoon so few people were in attendance and I didn't get much of a reaction. And the journal *Nature* rejected my paper." The point of Yokozawa's research had not been understood. But when he submitted his paper to the *Journal of the American Chemical Society* it passed through the review process smoothly. Suddenly the eyes of the world were on Yokozawa, and acclaim for his "startling results" began to build. He'd crossed the finish line. This was in 2000.

Yokozawa's research has greatly increased the potential for the creation of all kinds of new materials, from organic semiconductors to artificial fibers, and has already been applied in practice to things like OLED displays and solar batteries. "I chose chemistry in University because it is a field of study that is directly tied to people's everyday lives," he explains. He says that when he was a child he enjoyed building detailed model trains with his father. Perhaps to the child in Yokozawa's mind each car is like a monomer, and a long train of many cars becomes a polymer.

FEATURE

Living through 2017, a Major Turning Point in History

Sahashi is one of the few Japanese experts on American strategy on China.

Today this has become a very hot topic, and he has been bombarded by requests from the mass media.

He says that 2017 constitutes a major turning point in world history. He is right in the middle of this pivotal moment as both a historian and a scholar of international relations.

This is both exciting and challenging.

An East Asia in which the “Variables” Are Increasing

“Future historians may come to see 2017 as a historical turning point like the collapse of the Soviet Union in 1991 and the 9/11 terrorist attacks in 2001. I think the world order is standing at a juncture of this magnitude. It may not be the most appropriate expression, but for scholars of international relations it is without doubt a very interesting period.”

Sahashi says that in the last ten years the world has become fluid all at once. In Asia the development of nuclear warheads and missiles by North Korea has been added to elements such as the rise of China, the diminishing presence of Japan, and uncertainty about America under the Trump administration. The “variables” in this region have increased. When the “variables” increase the analysis of scholars becomes more complex and challenging. On the other hand, says Sahashi, precisely for this reason there is greater demand for scholars like him to contribute to society by providing various theories, analyses and hypotheses. Sahashi has in fact made many mass media appearances, speaking and writing his sharp and logical analysis.

“Whenever I give a talk or appearance, in addition to the current state of the Trump administration, I always explain the history of relations between American and China and other countries in Asia. Because without a ‘historical reference point’ by which to compare returning to the past or making a significant change it is impossible to understand [the present state of affairs]. If the work of journalists is to write a first draft of history, then the



Associate Professor Ryo Sahashi

Faculty of Law, Department of Law
International Relations

Ryo Sahashi

Born in Tokyo in 1978. Completed a doctoral program in the University of Tokyo Graduate Schools for Law and Politics in 2009. Holds a Ph. D. Has held his current position since 2010 after having served as an assistant professor at the University of Tokyo. His major is international relations, with a particular focus on America and East Asia, the Asia-Pacific security order, and contemporary Japanese foreign policy. In a Search for Coexistence: the United States and Two Chinas during the Cold War (Tokyo: Keiso, 2015). He has received various awards including the Kanagawa University Excellence in Scholarship Prize and the Japan Association for Taiwan Studies Distinguished Paper Award.

work of scholars is to evaluate history. We need to constantly return to history and compare it to the present. It is important to recognize the common threads running throughout history. Picking out clear “historical reference points” allows us to do this. I think this a scholar’s job.”

An Encounter with a Single Essay that Determined his Future

Sahashi’s decision to become a scholar of international relations, and US-China relations in particular, was sparked by an academic article he came across by chance. This article, by an American historian, discussed the American response to China’s nuclear development. This was during the first year of his Master’s degree, a time when his vision of his own future was still unclear.

“It was a fascinating essay. In 1964 China succeeded in developing nuclear weapon technology, and America knew about it. How should America respond? Various debates raged inside the government. Should they attack China’s nuclear facilities? Should they have another country do it? Unable to decide what to do, in the end America tacitly accepted the new reality. Next they moved to make sure another proliferation, preventing their allies such as Japan and Taiwan from developing their own nuclear weapons. The paper said that war was impossible because the cost was too high, America’s actions were determined by the dynamics among the US, China and the Soviet Union, and the movements of small countries like Japan should be constrained. Reading this I thought that international relations was incredibly fascinating. It moved according to its own logic, unconnected to superficial, external factors. Since I found it so interesting, I wanted to try writing my own dissertation.

His master’s thesis caught his professor’s eye, and several years later the paper he wrote based on it won an award from an academic association. Having thus been given the confidence that he could make it as a scholar, it was at this point that a young Sahashi chose to pursue a career in academia.

“I worked for half a year as an English teacher, then used the money I’d saved to visit America for three weeks and do various kinds of research. I repeated this many times. Most of the books in my office today were bought with money saved while pinching every penny I could and barely scraping by. Every waking moment was spent reading books and papers.”

A Fascination with Dialogue across Borders

Today he leads a very busy life, attending inter-

national conferences in Japan and overseas and visiting not only America but also China and South-East Asia to exchange opinions with other scholars in the breaks between his courses at the university. “Reality is always shifting, and the information you can obtain differs depending on the country. If you don’t gather information broadly you won’t be able to understand what is happening right now. So going overseas is absolutely essential.”

On the other hand, Sahashi also spends a lot of time shut away in his office meticulously poring over private documents, public records, and old newspapers that constitute precious historical resources. In any case the amount of information he has to deal with is enormous. Sahashi says that correctly understanding this vast amount of information is vital.

“What is interesting about this work is that I get to engage in conversations about how to interpret international relations that transcend national borders. Thailand, Singapore, Indonesia, America, Australia, Germany, Russia.... Being able to engage in intellectual conversations based on these countries’ unique information and way of looking at things is truly fascinating, and strengthens your abilities as a scholar.”

Apart from Sahashi himself there were almost no experts in Japan who studied American strategy on China, or, to put it another way, America’s worldview concerning on China, and even today there are very few.

“How has America viewed China over the last seventy years, and how will it do so going forward? I am studying this with a very limited number of colleagues, to the point that you might call it a solitary pursuit. If you don’t understand this, however, you cannot understand international relations. What happens in Asia is decided by America and China. Will America take the lead, or will China? Will these two countries cooperate with or confront each other? This is what will determine Asia’s fate. What are the possible outcomes? And which of them would benefit people the most? I think my job is to provide the intellectual resources for thinking about these questions.”

For relaxation he enjoys drinking wine. But rather than buy high-end bottles, he enjoys looking for cheap-but-delicious wine that delivers excellent cost performance. Right now his favorite wines come from California. The best wine he has ever tasted was given to him by the Georgian ambassador the year before the Russian invasion. This has become Sahashi’s “historical reference point” for wine. He is cosmopolitan to the core.



When he was a university student Sahashi attended Henry Kissinger when he visited Japan and assisted him with various studies. The photographs on display are from that time. As an aide to President Nixon and later Secretary of State, Kissinger was one of the main architects of America’s rapprochement with China.



Bobblehead dolls displayed in front of the collection of books bought through long hours of part-time work. From left: Sun Yat-sen, Chiang Kai-shek, Mao Zedong, and Deng Xiaoping.



His office is jam-packed with writings and documents. “Recently I’ve finally managed to draw a clear line between my work and my personal life, so I’m hardly ever in my office on the weekend.”

FEATURE

An Economics that Focuses on Human Happiness

The global financial crisis of 2008 was brought about by chaotic globalization.

This has resulted in various countries suffering from increased nationalism as an aftereffect.

Okuyama asks herself if Economics can provide a corrective prescription for a society in which the gap between rich and poor is increasing and the problem of poverty is growing. Economics, she says, is supposed to bring people happiness.



Assistant Professor
Satoko Okuyama

Faculty of Economics
Department of
Contemporary Business

International Economics

Satoko Okuyama

Born in Sendai City, Miyagi Prefecture in 1980. Completed a doctoral program at the Graduate School of Economics and Management, Tohoku University earning her Ph.D. in Economics in 2008. Became a full-time lecturer in Tokyo International University's Faculty of Economics in 2008, and has been an assistant professor in Kanagawa University's faculty of Economics since 2011.

Modern Economics at a Crossroads

Her father, mother, brother and Okuyama herself – the entire family – have all graduated from Tohoku University's Faculty of Economics, and her father still works there as a scholar. "I feel like I'm carrying on the family business," laughs Okuyama. She says that she has been especially heavily influenced by her father, a Marxist economist.

I studied modern economics, so my way of analyzing problems is different from my father. Modern economics emphasizes efficiency as the main judgment criteria. Therefore, it isn't very good at dealing with problems of economic inequality and poverty. But my father taught me the importance of thinking about questions like "What is happiness?" and "What is equality?"

Right now in Europe, Thomas Piketty has begun to gradually shift the focus from simply seeking economic efficiency toward looking at human happiness and social issues. This trend is a welcome development."

Okuyama says that modern economics is at a crossroads. "The financial crisis of 2008 came as a huge shock to modern economics. Until that point, in modern economics it had been said that the progress of liberalization and globalization would enrich nations. Financial crises had primarily been a problem of emerging and developing countries, and it was believed that liberalization and globalization should be pursued in those nations. However, the epicenter of the 2008 global financial crisis was America, a nation on the leading edge of liberalization and globalization. The crisis threw much of society into chaos, leading to the central banks and state financial institutions of these developed nations intervening in stock and bond markets, buying large amounts of stocks and bonds in order to prop up weakened economies. This was far different from the perfectly competitive markets upon which modern economics is based. Modern economics had seen the world on which it was premised collapse, and had lost any sense of what should come next."

Is It Possible to Predict a Currency or Financial Crisis?

The topic Okuyama is currently examining is "to what extent can we predict a monetary or financial crisis?"

"When a crisis happens no one can stop the panic. And even if stability can be restored temporarily through monetary policy, finding an exit strategy is incredibly difficult. So, is it possible to sound the alarm at an earlier stage and prevent a crisis from occurring? Okuyama is conducting research with this problem in mind. Not a 'weather forecast', but an 'economic forecast.' But unlike weather patterns that follow physical laws, in economics people's



The book Okuyama recommends most at the moment, *Sekai defure ha mitabi kitaru* [Global deflation is coming for the third time]. It is a work of non-fiction that describes the history of economic policy from the second half of the 19th century to the present day. Okuyama has herself read it twice.

thoughts and feelings overlap and influence each other, making prediction and forecasting very difficult. For example, the more credible the economic forecast becomes, the more the release of a report that 'good economic conditions will continue in Japan' will cause a capital inflow to Japan, paradoxically reducing its economic stability. By incorporating these sort of human behaviors in economic models, over the long term I hope to be able to find a monetary/financial system that will prevent monetary and financial crises from occurring." The currently in place policies enacted by various countries in response to the global financial crisis have placed the world's financial markets in a situation no one has ever experienced before.

"The 2008 global financial crisis, the chaos of which was caused by finance experts using financial services technologies, is a good example of a failure of capitalism. However, thanks to the technical development of policies to deal with the crisis, there was not the mass unemployment and decline in wages as seen in the Great Depression that began in 1929. In this country, too, the Bank of Japan enacted unprecedented monetary intervention, injecting vast sums into the markets by buying large quantities of stocks and government bonds. The fact is, however, that at this point no one can predict what possible future side effects these policies may have."

The Great Depression pushed the world to the brink, and gave rise to the catastrophe of the Second World War. With the 2008 global financial crisis, catastrophe was averted through unconventional monetary policy. While it may seem that stability has superficially returned, is there perhaps still the potential for a great upheaval and further consequences? Okuyama thinks there may well be.

"The money each country's central bank poured into the market is now circulating through globalized financial markets. We don't know where these might accumulate in the future and give rise to another crisis. And when the Bank of Japan sells the stocks and bonds it purchased during the crisis, prices will inevitably fall. Can the Bank of Japan actually enact this kind of policy? And if it can't, how will markets be normalized? The current situation where the Bank of Japan is the chief shareholder of Japan's leading corporations is not the kind of market economy on which existing economic theory is premised."

The Path Economics Should Aim to Walk

Okuyama also expresses doubts about neoliberalism and the push for less regulation in business activities and promotion of market principles to the greatest extent possible. "Neoliberalism has increased social inequality. As a result, the large middle class that had existed in Japan has withered, and attention has been focused on problems of poverty and disparity such as the increase in the number of irregular workers and the rate of child poverty. Around the world, too, growing inequality has caused division within countries and led to a rise in nationalism. Examples of this include last year's presidential election in the U.S. and the U.K.'s Brexit referendum on leaving the E.U. This state of affairs cannot be considered desirable."

There is also criticism that the current financial system lacks balance, and only a portion of the population is profiting from it. Is this system right? Okuyama says we must raise these questions about capitalism itself and find a way to resolve them.

Looking at the current world that is too chaotic and unpredictable, Okuyama sees a need for radical change not only in the financial system but in Economics itself.

"Economists are often said to be similar to doctors. A doctor determines a patient's condition based on data about their body, and then prescribes a treatment. To be able to do this, they must have a good understanding of how the body works. Likewise, for an economist to prescribe a remedy simply having data is not enough – they must also have a good understanding of economic systems. But is our current way of understanding currently good enough? Aren't there indeed other approaches and ways of understanding needed in order to give the right prescription? This is how I see it." At the core of economics is human happiness. On this point Okuyama's stance never wavers.



In her office at her computer.

Mathematics and Philosophy are Sisters

In his home country of France, as one might expect from the nation of Descartes and Pascal, even though he was a science student Bossard had a class in philosophy in his third year of high school. The influence this class had on him was significant. "It seems to me that mathematics can perhaps be seen as the technical aspect of philosophy. Maybe it is philosophy carried out using the tools of functions and operations. After all, they say that 'mathematics and philosophy are sisters'."

When he was in his first year of university, he met a certain Professor of mathematics. "I think it's the same in Japan, but when I was in high school I studied to solve examination problems without thinking very deeply about the meaning of the theorems and definitions I was learning. But this professor gave an insightful explanation of the essential meaning of questions such as "What is a function?" "What is a limit?" and "What is a differential?" It was the first time I had ever been moved in a math

class."

Here too Bossard was excited by the philosophical aspect of mathematics. This may have been the reason he chose to specialize in information science and computer science.

Bossard's specialty is graph theory. When you hear the word "graph" diagrams like pie charts and bar graphs may come to mind, but here graphs are mathematical structures consisting of vertices and edges. For example, a triangle is a graph made of three vertices connected by three edges, and is denoted as K_3 . Graph theory is a branch of mathematics that investigates how multiple vertices can be connected in this way, and a familiar example of its use is mobile phone transit apps that look up the fastest way to get from one place to another.

"Graph theory is a discipline that straddles the border between mathematics and information science, and my research has mainly focused on the problem of routing in the network of processors (a.k.a. interconnection network) that make up a supercomputer. Supercomputers have several million processors, and how they are connected is very important. If the

FEATURE

From the Country of Descartes to the Country of Ink Paintings

Along with conducting cutting-edge research in information science, Bossard has also received acclaim for his work on the Japanese writing system, relying on graph theory to put Chinese characters in relation to each other.

Leveraging the differences between the two nations of France and Japan, Bossard is always trying to "think outside the box."

Associate Professor
Antoine Bossard

Faculty of Science,
Department of Information Sciences

Graph Theory

Antoine Bossard

Born in 1984 in Normandy, France. Majored in mathematics and information science Université de Caen Basse-Normandie. Came to Japan in 2007. Served as a Project-based Assistant Professor at Tokyo University of Agriculture and Technology's Graduate School of Bio-Applications and Systems Engineering in 2011. Became an Assistant Professor of the Master Program of Information Systems Architecture at the Advanced Institute of Industrial Technology in 2012. Became tenured as an Assistant Professor in the Department of Information Sciences in the Faculty of Science at Kanagawa University in 2015, and is now an Associate Professor.

processors are not connected efficiently, the speed of transferring data between them will cause bottlenecks, and the performance of the computer will be greatly reduced. One part of my research is coming up with algorithms to find paths that will provide the most efficient connection between processors.”

The Ontology of Kanji

But why did Bossard choose Japan as the place to pursue his research?

“I was born and raised in Normandy, but from the age of eight I began learning judo at a club in my town. This got me interested in Japanese culture, and at my local library I read books on Japanese history and looked at collections of ink wash paintings. My interest in Japan grew even stronger when I watched movies directed by Akira Kurosawa and Takeshi Kitano and animated films from Studio Ghibli as a teenager.”

After entering university he began to study Japanese on his own. He was interested in the Japanese writing system, and made tables of the *hiragana* and *katakana* syllabaries that he memorized on the sly during his lectures.

“I met a Japanese exchange student at university, and taught her French in exchange for lessons in Japanese. That exchange student is now my wife,” says Bossard, a bashful smile on his face.

He finally came to Japan for his doctoral course. Another research topic he is pursuing involves the *kanji* [Chinese characters] he became familiar with in the course of studying Japanese and which are used in many countries throughout Asia.

“In this research I analyze the *kanji* writing system from a scientific, logical perspective. Here too I use graph theory, thinking of each *kanji* as a vertex and investigating the nature of the networks created by multiple *kanji* and the relationships between them.”

To give a straightforward example, relying on graph theory, the relation between the two *kanji* 櫻 [Chinese hackberry] and 夏 [summer] can be, for instance, described as follows:

$$d(\text{木}, \emptyset) + d(\text{夏}, \text{夏}) = 1$$

This expresses the “distance” between these two *kanji*. In this way the relationship between characters can be expressed in a diverse manner using logical notations, and a network created with *bushu* [component parts that make up *kanji*] as its vertices. Bossard suggests that by doing so, in addition to sound, meaning, and form, various additional connections between *kanji* we had not noticed before can be brought into view.

“Through this research I am trying to examine

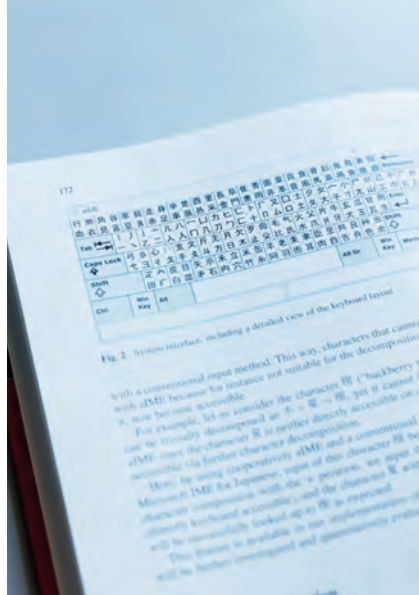
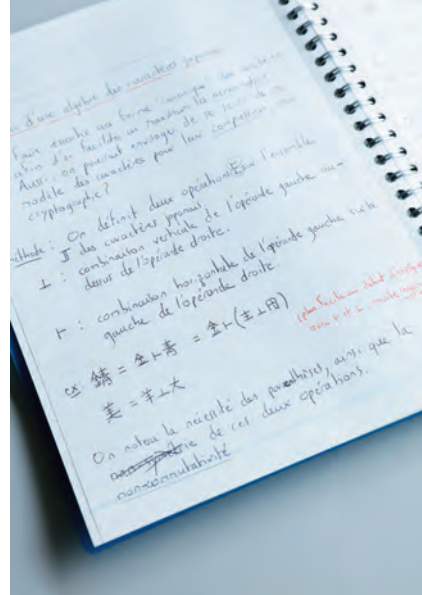


Fig. 2. System interface, including a detailed view of the keyboard layout

with a conventional input method. This way, characters that cannot be input with a conventional input method (IME) because for instance not suitable for the decomposition of a character were become accessible. For example, let us consider the character 櫻 (cherry blossom). It is not possible to input this character directly with a conventional IME. However, if we use the character decomposition method, we can input the character 櫻 by using successively IME and a conventional IME. For example, we can input the character 櫻 by using successively IME and a conventional IME. This feature is available in our implementation and will be implemented in our implementation.



Left: Idea for a *bushu* input keyboard that came out of his study of *kanji* systems. Right: Notes from his study of *kanji* writing systems. Ideas about defining the structure of *kanji* are written in French.

the ontology of these characters. What are *kanji*? What kind of characteristics do they have? Several answers can be found in the connections between them.”

What is Happiness to Me?

When it comes to practical applications of this writing system research, Bossard says he expects it to be used to come up with easier and more efficient ways for foreigners to memorize *kanji*, and to create new character input methods such as *bushu* keyboards. He also imagines it will become useful when A.I. has to deal with *kanji*.

“In my experience, in countries like China and Japan where *kanji* are used you cannot get very far without a deep understanding of these characters. But learning *kanji* one at a time is very difficult for foreigners. That’s why I think it is better to deepen one’s understanding of *kanji* and the characteristics of the system they create before trying to memorize them.”

Bossard is thinking about expanding the target of this research beyond *kanji* to include characters from other languages such as Egyptian hieroglyphics.

“I often say this to my students, but it’s important to think outside the box. This means changing your perspective and the rules that govern your way of thinking. Once you step outside the box your field of view expands. This is the case when studying *kanji*. The characters themselves are the box. For example, Japanese people use them on a daily basis so they cannot easily see outside of the box. *Kanji* appear in a new light when we use a scientific perspective to overcome this barrier.”

It’s been ten years since Bossard started living in Japan. His son born last year has now reached his first birthday. When asked, “What is happiness?” he replies as follows.

“For me happiness is spending time with the people I love, starting with my wife and son.”



Topology of an interconnection network Bossard proposed together with a colleague as an efficient way of connecting multiple processors.



Through his study of *kanji* writing systems Bossard has acquired many valuable writings and reference materials, including a copy of the *Kangxi Dictionary* that was published in the 18th century during the Qing dynasty.

Living with Gaudí

Torii found acceptance at a young age in Spain, the homeland of the Antoni Gaudí, and today he is known around the world as an authority on this renowned architect. But he had started out without any particular interest in Gaudí, and on the contrary even saw him in a negative light. Nagoya, Tokyo, Madrid, Barcelona... We journey back in time to when his unexpected encounter with Gaudí began.

Professor Emeritus
Tokutoshi Torii
 Spanish Architectural History



Tokutoshi Torii

Born in Hamamatsu City in 1947. Graduated from the Architecture Department of the Nagoya Institute of Technology in 1970. Spent eleven years in Spain studying Spanish architectural history at the Technical University of Madrid. Became a professor in Kanagawa University's Faculty of Business Administration in April of 2000. Currently Professor Emeritus at Kanagawa University. Member of the Advisory Committee of the Gaudí World Congress, Barcelona. Has written numerous books including *Gaudí no kenchiku* [*Gaudí's architecture*], *Kenchikuka Gaudí – Sono rekishitekisekai to sakuhin* [*Gaudí the architect – his historical world and works*], *Gaudí kenchiku no ruutsu* [*The roots of Gaudí's architecture*], and *Kenchikuka Gaudí zengoroku* [*Complete sayings of the architect Gaudí*].



Egyptian dovecotes that Torii thinks inspired the tower composition of the Sagrada Família.

“What on Earth is This? It’s Incomprehensible”

Having begun a hundred and thirty-five years ago, the construction of the Sagrada Família in Barcelona, Spain continues to this day. Everyone has seen this magical, mystical structure at least once in a magazine or on TV. The architect who designed this great cathedral that has been registered as a world heritage site was Antonio Gaudí (1852–1926). It has been ninety-one years since his death, but today he is perhaps the best-known architect in the world. Professor Torii is one of the world's leading experts on the study of Gaudí. He was one of only five Gaudí scholars from around the world invited to speak at a conference commemorating the hundredth anniversary of the commencement of construction in 1982, even though at the time, still in his thirties, he was a young scholar who had “come from the far East.”

But when he first saw Gaudí's architecture in a book, Torii says, “It aroused a negative reaction in me. What on Earth is this? It's incomprehensible.” This was when he was studying in the Architecture Department of the Nagoya Institute of Technology, so when he chose Spain as his destination when he went to study abroad it was not because of an interest in Gaudí. His studying overseas at all, in fact, was inspired by advice someone gave him, and was something

he decided in a single night. The person who gave him this advice was the legendary architect Seiichi Shirai (1905 ~ 1983).

His Encounter with Seiichi Shirai

When the young Torii was unsure about what path to take after graduating from university, he thought about working under Shirai. He went to Tokyo to see Shirai, and in spite of waiting in the entrance of his house all day when he was told the architect was not there, was unable to arrange a meeting. In response to a subsequent letter, however, he received an unexpected reply: “Please come and visit me at home any time.” He went back to Tokyo, and his meeting with Shirai, a known night owl, began at eleven o'clock in the evening. Right at the start, Shirai said, “I don't have any work right now, so I don't need an apprentice.” Torii recalls what happened next as follows.

“Then he said, ‘If your youth really yearns for architecture, why don't you go abroad and play for a while?’ Perhaps because Mr. Shirai himself had gone to Germany to study in his youth, he strongly recommended studying abroad. When it slipped out that I had learned a bit of Spanish, he said that if so I should go to Spain.” Having missed the last train from Shinjuku Station after leaving Shirai's house, the young Torii spent the night at an all-night movie theater. Absent-mindedly staring at the screen,

he reflected on Shirai's words. By the time he boarded the first train in the morning, he had come to a decision. "I have to go." That was in the fall of 1969, when he was twenty-two years old.

After graduating and moving to Tokyo, Torii needed to study Spanish and worked part-time jobs as a paperboy and security guard at an elementary school while saving money to study abroad. Four years later, in the summer of 1973, Torii left for Spain in high spirits.

When He Got off the Subway in Barcelona...

Studying Spanish architectural history in the Technical University of Madrid's Architecture Department (Superior Technical School of Architecture of Madrid), several times he was assailed by doubts about his chosen path, wondering what exactly he was doing there. "When I sent Mr. Shirai a letter about my confusion, he wrote as follows in a reply that arrived three months later. 'That is the same as the question, "Why am I alive?" The answer can only be found by throwing yourself into life wholeheartedly.'

The following spring, having adjusted to his life as a foreign student, Torii had a completely unexpected encounter with the architecture of Gaudí. He visited Barcelona during a one-week break from school, intending to conduct a survey of medieval gothic architecture. When he got off the subway and climbed up to street level, Torii was awestruck. Before his eyes stood one of Gaudí's masterpieces, Casa Battló. "I was literally paralyzed. My body tingled and I couldn't move. Gaudí's architecture really cannot be reproduced in the two-dimensional media of photographs and paintings. You can't understand his buildings unless you actually visit them and experience them in three-dimensional space."

Having undergone this shock, Torii changed his plans and walked from one of Gaudí's works to another, including Casa Milà and Park Güell. After returning to Madrid, too, he continued to pore over books and other materials related to Gaudí on the side while pursuing his studies in Spanish architectural history. Then in his fifth year of studying abroad Torii decided to write a paper on Gaudí. Written in Spanish over the course of a year, the manuscript ran to over 600 A4 pages in length. When he showed it to his professor, to his surprise he was told that owing to its originality it was worthy of being published. After five years of editing and revision, this text was finally completed and published by the Instituto de España with funding from the national government as *El*

mundo enigmático de Gaudí [The Mysterious World of Gaudí], a major work in two volumes. Torii was thirty-six years old.

Living without Knowing Your Next Step

Today Torii serves as a member of the "Advisory Committee" of the World Gaudí Conference that has its headquarters in Barcelona. He describes his approach to the study of Gaudí as "adopting the role of Gaudí himself and studying him from the perspective of a creator." In examining Gaudí's unique and mysterious style, and the inspiration behind it, Torii does not stop at the era in which Gaudí lived but attempts to travel through time to more ancient eras and get to know them through Gaudí's eyes, ears, and skin. "For example, one thing I found mysterious was the group composition of the towers of the Sagrada Família. When I looked into it, I found an illustration of Egyptian dovecotes in a book by a government emissary born in Barcelona who travelled from North Africa to the Middle East at the beginning of the 19th century under the Arabic name "Ali Bey," and had the immediate sense that it must have influenced Gaudí. I also found other connections between Gaudí and Ali Bey, such as that a Spanish diplomat living in Cairo when Ali Bey was studying there was a close friend of Gaudí's and that Gaudí was acquainted with the painter responsible for Ali Bey's portrait. Doves have been seen as messengers of peace and symbols of the spirits of the departed, so from ancient times dove coups have been associated with churches, the home of God."

In this way Torii's search for the origins of the images that moved Gaudí transcends time and space. He lays out what can be described as Gaudí's "map of inspiration," accompanying it with persuasive historical evidence. Perhaps for this reason, when his writings were first published in Spain Torii's view of time as a clump or solid mass was deemed "Eastern" in contrast to the "Western" sense of time as a line.

When asked about his message for young people, Torii responds as follows. "The way to enjoy life is to live without knowing what your next step forward will bring. It is not knowing that fills you with energy."

Torii is uniquely positioned to make such a claim, having decided to study in Spain in a single night and taken up as his life's work the study of Gaudí, an architect he had originally disliked and found incomprehensible.



The Casa Battló in Barcelona. The first work of Gaudí's Torii saw, it left him awestruck.



Torii's book *El mundo enigmático de Gaudí [The Mysterious World of Gaudí]*, published by the Instituto de España. It came out just one week after Seichi Shirai had passed away.



Citing articles about caves in contemporary magazines and cave-like features of the sets of Wagner's operas, Torii holds *El mundo enigmático de Gaudí* open as he explains how the moldings reminiscent of caves that appear in Gaudí's works seem to have been part of the common figurative vocabulary of the era.



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