Goal 9 R&D Project

Maximizing well-being and agency on the basis of interpersonal comparison of brain indicators

Newsletter 03

Towards Social Demonstration Trials After the Midterm Evaluation

Three years have passed since the official launch of this project, and this fiscal year marked a major milestone with the midterm evaluation. Thanks to the tremendous understanding and efforts by the principal investigators, research participants, and all those supporting the project at affiliated institutions, we have successfully progressed into the fourth and fifth years. I would like to express my heartfelt gratitude to everyone who has shown interest in and supported our endeavor.

Looking ahead, we will focus on advancing research plans and demonstrating the methods in real social contexts to establish a crucial foundation for societal implementation. By the end of the fourth year (January 2026), the project will face a significant stage gate to determine whether we can proceed to societal implementation in the sixth year and beyond. This juncture will serve as a test of the project's true value, and we are determined to rise to the challenge. We kindly ask for your continued understanding, cooperation, and support in this endeavor.

The aim of this project is to develop brain indicators that allow interpersonal comparison. By leveraging these indicators, we strive to create technologies and systems that evaluate and select policies to maximize individual "joy" and "aspiration", as well as societal "well-being" and "agency". While we have been contemplating how to conduct the social demonstration trials, we are considering the possibility of utilizing the unique environment of Tamagawa Academy & University, the representative institution of this project. This educational setting, where people of all generations share the same campus, provides an ideal platform to explore education policies through evaluation and comparison using these brain indicators.

Education, in our view, is not merely a venue for developing human resources. It is an integral part of society and a driver of social progress, where the current and next generations collaborate to shape the future. This perspective is reflected in the Educational Forum we initiated this year (pp. 2–7). While the development of brain indicators for "joy" and "aspiration" remains preliminary, we have confirmed their ability to enable interpersonal comparisons. As we prepare to collect brain indicator data that might emerge in various educational settings, I am genuinely excited about tackling the unprecedented challenge of aggregating this data and discussing its implications for education policies.

If this endeavor leads to the realization of new systems that genuinely enhance individual and societal well-being, the responsibility we bear is immense. I believe this responsibility must be supported by the scientific legitimacy of brain indicators and the ethical considerations in social choice. As the Project Manager, I am confident that all members of this project are equipped with the passion, ethical awareness, and logical rigor necessary to shoulder this responsibility. With this conviction, I reaffirm my commitment to the project and humbly seek the continued understanding and support of the public.

Project Manager (PM)
Kenji Matsumoto
Professor, Brain Science Institute, Tamagawa University

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Matsumoto: Thank you all for joining us today for the First Roundtable in the Series: Educational Forum Well-being and Agency'—The Future of Education Unveiled by Neuroscience—. We are honored to welcome Mr. Kenta Kimura, who has been a driving force behind innovative education at Chiyoda Junior and Senior High School as well as at his previous post at Hiroo Gakuen. We look forward to hearing about his experiences in education. Thank you for being here today.

Kimura: Thank you very much.

The Purpose of Education

Matsumoto: To begin, I'd like to hear about your perspective on education, Mr. Kimura. Looking at the pamphlet from Chiyoda Junior and Senior High School, it says, "School is a place to create the future." This aligns quite closely with the goals of our project, I believe.

Kimura: Yes, indeed.

Matsumoto: Additionally, the phrase "From international to a planetary scale" caught my attention. It seems to go beyond the idea of being merely international, encompassing nature and addressing values at a unified global level in a fundamental and essential way. Furthermore, your school has introduced not only a research track but also a development track, which feels like a significant step forward.

Kimura: Thank you.

Matsumoto: And here, "Creating happiness for oneself and for everyone else" is another statement that resonates deeply with the mission of this Moonshot Project, which also aims for the happiness of individuals and society. This connection is why I'm particularly eager to hear your thoughts.

Kimura: I'd like to share my thoughts on the purpose of education. Nowadays, artificial intelligence is the dominant topic, and adapting to societal changes is certainly important. However, we are serious about believing that students themselves can create an exciting future.

When people think about education, they often imagine a system designed to impart knowledge that helps individuals adapt to existing societies or nations. Educators focus on delivering the contents of textbooks, while students, in many cases, passively receive the information.

When we started Chiyoda Junior and Senior High School, we decided to redefine what a school should be. We asked, "What kind of environment is a school?" and concluded that it's a place where students create the future. Thus, the role of educators is to help students acquire the mindsets, qualities, and skills necessary for this task. Furthermore, we, as educators, are part of the same generation responsible for shaping the future alongside them. Schools should be spaces where we create the future together.

For example, in many private schools, the focus is often on a successful future shaped for students, measured by academic achievements like getting into prestigious universities. While this is an understandable starting point, I believe that by the time students graduate, they should have a mindset that envisions a future to be created by students themselves on a global, or rather nature-centered, planetary scale. We want them to thrive with such a

perspective.

The idea of "creating happiness for oneself and for everyone else" aligns with the OECD Learning Framework 2030. This framework sets the goal of education systems worldwide to achieve individual and collective well-being by 2030. This goal has gained global consensus.

Matsumoto: Yes.

Kimura: This concept is exactly what we aim for. We tell students that they should create a future where they and everyone else can be happy. Schools should foster such an environment, empowering students to be the main agents of the future. Education should involve creating something together, nurturing such a mindset.

Matsumoto: I see.

Kimura: Another key word is "fun." In education, I think the question of "What is fun?" serves as a starting point. For example, "fun" might begin with interesting experiences. Ideally, this evolves into something exciting through research and discovery. Such excitement should lead to the ability to create new values and tackle unsolved challenges for humanity.

However, in reality, some students struggle with certain subjects and may not find them enjoyable from the start—in fact, they might be the majority. That's why we must ensure that every student has access to that initial level of interest (funny), incorporating entertainment elements as a gateway. Personally, one of my main goals in joining today's discussion is to explore how schools can systematize and implement the idea of "learning like playing and playing like learning," including quantifiable KPIs.

Regarding the research and development tracks, these aim to connect middle and high school curricula with university-level academics and societal needs. The research track involves foundational and applied research, focusing on creating something entirely new—from zero to one. On the other hand, the development track emphasizes entrepreneurship and social innovation, such as transforming corporate seeds into socially implementable solutions.

For example, students might address environmental issues, SDGs, or regional challenges, even proposing policy solutions. In practical terms, the research conducted by students is serious. Even junior high students must review previous studies to ensure their work is novel. However, the goal isn't simply to be able to read academic papers—it's to instill the desire to read them. I want students to ask, "Why is prior research important?" and think, "I want to read academic papers, so I need to improve my English." Such desire is what I call "fun."

Another crucial aspect is creating an environment where students can engage with the real world, reflecting the importance of external factors or the environment. We place great emphasis on exposing students to authentic experiences. For instance, at our school, external experts participate not just as educators with specialized knowledge but as individuals who genuinely want to learn from and engage with the students.

We call these people "dedicated adults," and we deliberately involve only those who are genuinely passionate about working with students and learning together. Unlike in my previous school, where experts with high specialization were invited primarily for their knowledge, at Chiyoda, we emphasize collaboration, where even the adults learn from the students. This approach fosters the mindset we've been discussing—a global, or rather planetary, perspective to shape the future.

This mindset also impacts performance significantly. For example, one of our students, part of the Number Theory Team, shared this experience:

Student Video: "While working on number theory research, I've been learning to prove Euler's theorem and tackle difficult problems. This process made me realize I'm not as 'stupid' as I had once believed."

Kimura: This student initially struggled with math. When we started experimental research programs around May, around midterm exams, she was one of the students who joined voluntarily. Over the next three months, she worked closely with a teacher, enjoying the process of learning mathematical techniques and exploring what math truly means. By the time the final exams came around, her score had improved significantly, and her self-esteem skyrocketed.

This illustrates how quickly students can change within just three months—how fun transitions from being just fun to interesting, and further to truly exciting. This change may foster self-esteem, self-efficacy, and other happiness-related indicators, though we haven't formally measured them. I believe this area holds much more potential for exploration.

Returning to the original theme, I believe the purpose of education is "to create the future." The methods to achieve this are diverse, and even for educators, it raises questions about what constitutes well-being in education. In reality, we are still navigating this path through trial and exploration.

While surveys and indicators from educational psychology and pedagogy provide valuable insights, I often feel they don't fully capture the essence. Today's discussion, especially involving neuroscience perspectives, offers a level of credibility that could be transformative.

Topics for Further Discussion:

- **The responsibility for cultural values and their evolution lies with the next generation.**
- **Younger generations hold unique strengths in the digital age.**
- **Learning is a prerequisite for creating the future.**
- **Adults in Japan have largely stopped learning.**
- **Education provides opportunities to recognize the significance of learning.**

The Right to Learn and Lessons from History

Gotoh: Thank you very much. That was an incredibly engaging and inspiring discussion.

I'd like to offer two points from a slightly different perspective. The first point is about the 1985 UNESCO International Conference on Adult Education, where what's now referred to as the Paris Declaration was issued. I often introduce this to my students. It states:

"The right to learn is: the right to read one's own world and to write history; the right to have access to educational resources; the right to develop individual and collective skills."

Those who have never experienced education may not even realize that they need it. This idea ties directly to the discussions we've had today. For this reason, I believe that the essence of what you, Mr. Kimura, have shared today is extremely important.

What's particularly fascinating about your perspective is the connection between the individual and the collective.

Rather than climbing out alone to join the majority society, it's about caring for those around us and collectively preserving and building our shared history.

The second point is from a completely different angle. I find myself caught on the phrase "creating the future." Of course, creating and envisioning the future is crucial. It leads to excitement, boosts motivation, and is inherently meaningful.

However, we must also address the things humanity has done in the past. For example, consider the atomic bomb survivors, who were silenced under the press code for so long after the war, or the tragedy of Minamata disease, or the genocide of Koreans after the Great Kanto Earthquake. These are all parts of history that we must learn and come to terms with.

When embarking on future-oriented projects, I am wholeheartedly supportive. At the same time, I believe it's essential to reflect on and embrace the lessons imparted to us through the immense sacrifices of so many people, including those who lost their lives. How we learn and internalize those lessons is just as important as building the future.

Kimura: Thank you very much. I will take your words to heart.

Gotoh: What you're saying is rooted in your real-life experiences and driven by genuine conviction, and I deeply respect that.

Kimura: Thank you. In our country, students are divided into two tracks: 'science' and 'humanities.' Those in the science track rarely study history in depth, making it difficult to develop a broad understanding. When we approach history not as an isolated subject but as something interconnected with all disciplines, we see its relevance across time and society.

Learning is not limited to science; it's about the

fundamental aspects of being human. The more we connect academic subjects with society, the more we can recognize these essential truths. This discussion has given me valuable insights, especially about bridging the gap between academic subjects and society. I also feel increasingly determined to break away from the dichotomy of science and humanities at an early stage in education.

Gotoh: I completely agree with you on that.

Kimura: I would even like to incorporate philosophy into compulsory education. After all, every branch of science ultimately leads to philosophy.

Topics for Further Discussion:

- **Learning as an essential activity of life.**
- **The formation of self and internal models of self and others.**
- **Joy: from neural reward systems to the basis of social empathy.**
- **Aspiration: from motivation to metacognitive action with purpose.**
- **Well-being: ensuring individual joy is integrated into well-being of society.**
- **Agency: fostering a society where every individual's aspiration can thrive.**
- **Schools as spaces for nurturing well-being and agency.**

Youth Suicide

Gotoh: If I may add a third comment, it would be that the leading cause of death among younger generations is now suicide.

Matsumoto: Yes.

Gotoh: In 2016, the Act for Eliminating Discrimination against Persons with Disabilities was enacted, and the Cabinet Office has since emphasized the need for reasonable accommodations in educational settings. For example, there's a supplementary textbook for middle school health and physical education titled "Do I have to endure my worries alone?" It seems to have been developed by Dr. Kasai and others from the University of Tokyo's faculty of Medicine. This ties into the idea of the agency. When we talk about the agency, it raises the question of whose agency we are addressing and to what extent.

We inevitably view others through the lens of our own upbringing, experiences, common sense, and assumptions, confining our understanding to the boundaries of our personal perspective. But we've always been challenged to broaden our view to encompass the other half of the world we don't know—the half outside of our own awareness.

Perhaps humanity has made some moral progress in this regard. The fact that even the Cabinet Office is now addressing these issues suggests that we are beginning to recognize them as pressing concerns that demand action.

Kimura: Just yesterday, I had the opportunity to speak to our middle and high school students during First Day Assembly. I talked about how we've often been told to "put yourself in someone else's shoes" or to "avoid doing things to others that you wouldn't like yourself," and I, too, believed in these principles.

But does putting yourself in someone else's shoes truly mean considering their happiness? After all, the other person is not you. The moment you imagine yourself in their position, it may become, ironically, an act of extreme self-centeredness. I shared this idea with the students.

Of course, maintaining the attitude of striving to understand others is important and worth pursuing. However, as you mentioned, Professor Gotoh, there are worlds beyond our understanding—worlds that we might never fully comprehend, no matter how much effort we invest in understanding.

Rather than trying to feel our way into understanding relationships—a process often driven by intuition—I suggested that it might be easier to approach these matters by framing them as knowledge to be acquired.

After all, intuition may fail us. For example, while the smell of freshly cooked rice is comforting to many of us, it's unpleasant to some people from other cultures. Whether or not we can be considerate in advance and adjust accordingly in such situations often comes down to knowledge.

When it comes to personality development, especially among children, relationships with friends tend to be

perceived through the lens of feelings. However, knowledge plays a much larger role than we might assume. In fact, I believe knowledge is often the key to fostering positive relationships. Just conveying this idea—that knowledge is crucial—might help resolve a lot of issues.

Topics for Further Discussion:

- **Learning continues throughout daily life.**
- **The joy of interpreting knowledge individually.**
- **The role of education in personality development.**
- **Words can sometimes act as "curses."**
- **Education must avoid suppressing individuality and potential.**
- **Flexible and liberating educational environments depend on teachers.**

Cognition, Emotion, and Will

Matsumoto: In neuroscience, we often talk about cognition, emotion, and will as the three fundamental elements of the mind. Within our project, we focus on "joy" and "aspiration," which correspond to emotion and will. While we've been exploring the hierarchical structures from simple pleasures to social joy, and from basic motivation to actions involving metacognition, I believe we should similarly examine the hierarchical structure of cognition.

Additionally, it's clear that emotion and will interact with one another, but I've been reflecting on how cognition also interacts with both.

Kimura: That interaction feels significant.

Matsumoto: Knowing oneself is, in a sense, part of cognition, isn't it?

Gotoh: It's recognition.

Matsumoto: Knowing others—while this doesn't directly involve empathizing with their emotions or will—provides a meta-perspective to reflect on one's own emotions and will. In education, cognition is often treated as acquiring knowledge in academic subjects. But I've come to realize that we need to reevaluate the broader role of cognition.

Kimura: A reading teacher once shared an interesting observation. In one passage, a sunset was described as "melancholy." While this scene resonated with the humanities students, the students in the science-oriented classes struggled to grasp why the sunset was described this way.

The teacher implied that while the science students were academically strong, their emotional sensitivity was underdeveloped. What the teacher meant by "academically strong" was having knowledge.

But is feeling melancholy at the sight of a sunset purely a matter of emotional sensitivity? Couldn't it also be a matter of knowledge?

The idea that a sunset could be described as beautiful, or melancholy might depend on the knowledge we possess. I started to think that the emotional response to a sunset could, in part, be informed by knowledge.

The interrelation between cognition, emotion, and will—and how we define each—is worth exploring. Additionally, encouraging children to classify their thoughts and experiences within these three categories could provide great benefits for their personal growth.

Topics for Further Discussion:

- **Practical examples of connecting this framework to academic subjects (e.g., mathematics research).**
- **Mathematics class as a space to detach from daily life.**
- **Teachers as mediators who create learning environments.**
- **Rich learning experiences that cannot be replaced by video lessons.**
- **Learning in an environment that fosters freedom and is free from pressure.**
- **Students and teachers collaboratively exploring solutions.**

Evaluation

Kimura: When discussing evaluations in schools, the conversation often becomes misaligned. Some evaluations are meant for the benefit of students, while others are used for selection, such as university entrance exams.

For example, regular tests at school are created by the very teachers who have taught the students. These teachers carefully select key points and design questions for the test. This is incredibly valuable—having a specialized professional create these assessments is a tremendous advantage. However, students often fail to appreciate this while they're still in school.

For instance, the meaning of scoring 80 points on a midterm exam versus scoring 80 points on a mock university entrance exam is completely different.

Gotoh: They're incomparable, aren't they?

Kimura: Exactly. Mock exams are modeled after university entrance exams designed for selection purposes. Scoring 80 points on a test meant for selection and scoring 80 points on a regular test represent entirely different things.

Another point is the need to collect outcomes from school

programs and educational approaches as concrete "results." For example, we often see fear-based or crisis-driven messaging being used, but if you would collect the data, this approach would be ineffective.

Gotoh: That's an extremely important point. Especially in cases involving developmental disorders, it can be particularly problematic.

Kimura: In fields like pedagogy or psychology, there are small-sample studies that suggest certain trends, but they often lack sufficient credibility. However, if we could use brain indicators and observe these trends in large sample sizes, it could reveal truths like, "This is how humans are," or "This is biologically inherent to humans." That would have a tremendous impact.

Education is a field where it's inherently difficult to produce evidence. Short-term evidence is especially hard to generate. As a result, we often rely on KPIs like how much test scores improve or how many students get into prestigious universities. If we can incorporate brain indicators to measure outputs to some extent, it could serve as a powerful tool in a field where evidence is so challenging to obtain.

Social Structure

Matsumoto: I think there are many issues related to evaluation, but ultimately, people should be able to live however they wish—that's a right guaranteed by the Japanese Constitution. If that's truly the case, then there's no need for fear.

However, within the country, competition exists, and on an international level, there's also competition—this creates the narrative that we must work hard not to lose to other nations. As a result, we end up categorizing people into those who are seen as living valuable lives and those who are not. Then comes the question: "Are you okay with being someone whose life lacks significance?"

Unless we eliminate that structure, ….

Gotoh: Thank you. That's exactly what I wanted to say. It's something social scientists should be addressing. Truly, that's the core issue.

Matsumoto: I believe this is something everyone needs to be aware of. Teachers and schools need to understand it, and so do adults in society. If that awareness spreads, the environment of education will inevitably change. But it's a difficult task.

Gotoh: When I talk with professors in education at Hitotsubashi University, that's precisely where the problem lies. Since the post-war period, we've seen numerous reforms to education laws, including the 6-3-3-4 system, creating various branching opportunities. In theory, diversity in education has become much more accepted.

For example, you can graduate from a vocational school, pursue a master's degree from there, and so on. These pathways exist, but once you enter society, it all gets measured by a single set of criteria—corporate hierarchy and labor productivity. As a result, those who have embraced the ideal of freedom in education might struggle with the gap they face when entering society.

We need to learn from the outset—not just as individuals but collectively—about the possibility of such outcomes. It is important that everyone acknowledges this as a shared issue, addressing it together and creating an environment where both adults and children can engage with it.

Kimura: Until Professor Gotoh went deeper into the underlying issues of education, I thought that when talking about schools, I had to say things like, "This program improves grades," or "Our students get into top universities." Otherwise, I'd assume no one would listen. It's only after all this time that I feel comfortable talking at this level.

What we discuss internally within schools and what we talk about externally often diverge. Practically speaking, no one listens otherwise. If you say, "This is wonderful education," or "Isn't this what creating the future is about?" it is often ignored or dismissed as irrelevant.

As a result, we tend to discuss the fundamental aspects of education only among members with shared goals. However, implementing those discussions directly is nearly impossible. We still need one foot in the current value systems of society to produce tangible results.

In private schools, for instance, we need to present outcomes such as, "Students can enter universities like these," or "Look how much their grades improve!" I consider this a tool to achieve our goals. Without results, there's no credibility to back our efforts.

In the past, I thought it was fine to pursue my ideals, especially during the time I focused on research. But now, I feel that achieving societal implementation or integration into larger frameworks, such as national systems, requires accommodating broader desires, even if it involves some degree of compromise.

Sometimes, I question whether short-term metrics are sufficient, but I find myself thinking, "If that's what's needed, I'll deliver it."

I wish we could have these kinds of discussions with middle and high school students. If we truly want to change society, we need to include these topics. As you've said, if we only focus on pure ideals, students might become disillusioned and break under pressure.

At my previous school, I used to say to my class on the day of graduation, "Starting today, we're no longer teacher and student—we're friends." I'd add, "We've worked on what schools could and should be, explored approaches to science and math under pressure from above, but this isn't about blaming anyone."

I'd explain, "If you try to overturn the current system, you'll face resistance and obstacles. But from today, I see you as allies, so let's bring this to life together." While this might seem like a short-term perspective, I view it as a way of restoring things to their proper form rather than reforming them.

We might also need to teach students how to behave when they join an organization or use their skills in a job. At the very least, it took me a long time to figure out how to approach turning ideals into reality. Even now, I'm not sure how much, or what exactly, we should pass on to the next generation that will shape the future.

Topics for Further Discussion:

- **Universities as havens for discovering joy.**
- **A society that values education's contributions.**
- **Challenges faced by idealistic youth.**
- **Using brain indicators to create a more livable society.**
- **Challenges in Japan's mathematics education.**
- **Ensuring students have time to think about math.**
- **Training to grasp the essence of problems.**
- **Enjoying mathematics as "play."**
- **Naturally developing problem-solving skills.**

Essential Learning and Academic Performance

Kimura: To be honest, I've decided to make sure students achieve good scores in the end. However, I believe that focusing on the essence of each field of study and fostering a sense of enjoyment should come first. When students pursue these aspects fully, they eventually become capable of solving university entrance exam problems.

If a student is determined to study in a specific lab with a specific professor at a specific university, we help them achieve that goal. We also teach technical strategies for entrance exams to high school seniors. However, I firmly believe that the essence of academic subjects matters most, and I continue to explore ways to convey it without making it a trade-off with exam preparation.

The mindset of focusing solely on mastering university entrance exam techniques can distance students from academic depth. I think that if we could plan learning in a way that prioritizes the essence, it could create a domino effect where many other issues are resolved, leading to better outcomes overall.

Topics for Further Discussion:

- **Utilizing lessons and materials for exploratory learning.**
- **The necessity of generalizing educational methods.**

Closing Remarks

Matsumoto: Well, it seems about time to wrap up. In the final discussion, the idea of thinking freely stood out as particularly important. The ability to live freely and think freely in any context should be fundamental goals of education. Our aim is to eventually make this visible through brain activity. That, I believe, is what we should truly evaluate—not academic performance or similar metrics.

I'm not sure if this conclusion ties everything together neatly but thank you all for today's engaging and enjoyable discussion.

Kimura: Thank you very much.

Gotoh: Thank you very much.

International Workshop “Well-being and the Future of Industrial Relations” Held

Many readers might find the term “Industrial Relations” unfamiliar. In Japanese, it is often translated as “労使関係” (labor-management relations), yet even this term may not resonate with some. Perhaps during the annual spring labor negotiation (known in Japanese as “春闘,” an abbreviation of “春季生活闘争,” a term coined by RENGO, Japan's largest labor union federation), some may have overheard news about negotiations between labor unions and companies. If so, that might provide a vague reference point for understanding industrial relations.

This international workshop brought together experts in industrial relations from around the world for an academic conference. Approximately 30 participants convened over a day and a half, during which 12 research papers were presented. Time was devoted to refining each study through sharing ideas and analyzing individual components, with participants offering insights and feedback. In several instances, research materials transformed rapidly through this collaborative process, embodying the very essence of what a workshop should be.

However, some readers may wonder why the focus was on well-being and industrial relations. Originally, well-being was a concept used to evaluate the state of an individual. It was often considered incompatible with the motivations of social science, which emphasizes the dynamics of relationships, groups, and societies. Yet, it is easy to imagine scenarios where individuals seek others’ opinions to evaluate themselves or where they find hypothetical versions of themselves in others, linking these perceptions to their well-being. In some cases, unsolicited input from others might even play a significant role in shaping one’s well-being. Whether individuals feel miserable or admirable is often intertwined with societal norms. Thus, in today’s society, it is essential to consider well-being beyond the level of individuals alone.

But who exactly constitutes these “others”? Parent and child, teacher and student, doctor and patient, manager and subordinate—such dyadic relationships might come to mind. However, “industrial relations” has never been a matter of just two parties. For instance, a labor union—one side of industrial relations—requires more than one member, and when including representatives of the employer, at least three people are necessary. This suggests that the foundation of industrial relations inherently involves the wisdom of incorporating a “third party” rather than limiting the interaction to two individuals.

In social science, the concept of “intermediate organizations” has been used to organize relationships involving three or more parties. When modern society established the relationship between the state and the individual, these intermediate organizations played a mediating role and, at times, even took on the decision-making responsibilities of the state. Families, schools, and trade associations are examples, and labor unions also belong to this category. This workshop’s research group similarly exhibits the characteristics of such intermediate organizations.

With this context, one might begin to form a hazy image of how industrial relations relate to well-being. When we evaluate something, we are inevitably influenced by the norms formed by the intermediate organizations to which we belong. Conversely, without considering the mechanisms of norm formation within intermediate organizations, the concept of individual well-being cannot fully take shape. This logical progression is not merely theoretical. When considering workplace

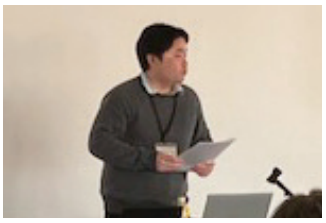
Presentation at the venue

well-being in practical terms, the involvement of workplace intermediate organizations, such as labor unions, in these norm formation mechanisms becomes an essential perspective. Thus, the relationship between industrial relations and well-being offers valuable insights for well-being research.

This workshop focused on examining the characteristics of various data sources, including government statistics, survey research, and case studies, to investigate the underlying mechanisms at play. While the connection to well-being remains a work in progress, participants concluded that situating well-being research within social science—considering it beyond the level of individuals—offers significant meaning. The workshop was a valuable opportunity to recognize this broader perspective in well-being research.

Ryo KAMBAYASHI (Musashi)

Akie NAKAMURA (RENGO-RIALS)



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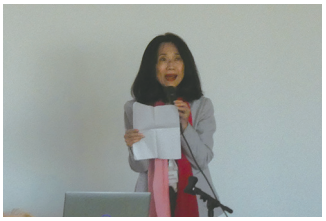
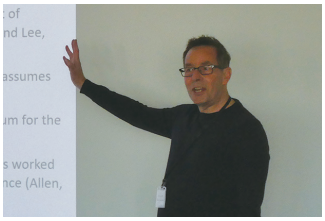


Reiko GOTOH (Teikyo)



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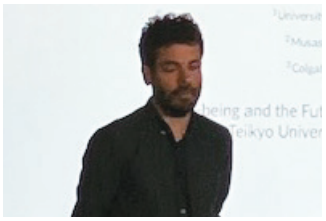
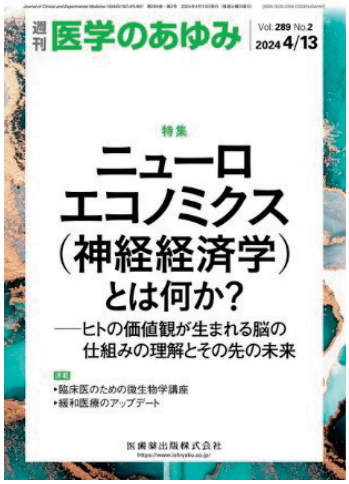


Gabriel BURDIN (Siena)

What is neuroeconomics?
—Understanding the brain mechanisms that generate human values and the future beyond

4-1 Hiroshi Yamada, 1-1 Reiko Gotoh, 3-1 Kaosu Matsumori



In the fall of 2023, we held a symposium on neuroeconomics titled "How does our valuation system operate in the economic sense?", and following that, a special issue on neuroeconomics was published in Igaku no Ayumi.

PI Hiroshi Yamada wrote the introduction and selected the candidates for the writing of the article. Everyone he asked readily agreed, and resulted in a very appealing special issue. The Authors' committee is the followings*: economics experts, experts studying the mechanisms of the human and monkey brains, disease experts, As part of our efforts to create a better society, our project team has written two papers: Project 1-1, "Narrowing down words related to welfare and autonomy using normative economics methods," by PI Reiko Gotoh, and Project 3-1, "Obtaining brain indices of joy and aspirations using human MRI and comparing them between individuals," by PI Kaosu Matsumori. They discussed the issues surrounding research that is breaking new ground in the integration of humanities and sciences, and made bold statements about what Japanese society needs in the future. This was a very meaningful special issue, as it uncovered many challenges for research and social implementation with an eye toward Japanese society 30 years from now. We have taken a good step towards achieving our goal of creating a spiritually rich and dynamic society by increasing mental peace and vitality by 2050.

Moonshot9 : Author of "Maximizing welfare and autonomy based on inter-individual comparison of brain indices"


Hiroshi Yamada


Reiko Gotoh


Kaosu Matsumori

*Contents

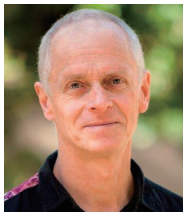
3-2 Predictive Coding: Understanding Autism through Neural Mechanisms in Model Marmosets

Principal Investigator (PI)
Madoka Matsumoto
Human Brain Research Center, Graduate School of Medicine, Kyoto University
Specially Appointed Associate Professor

Predictive coding is a theoretical framework suggesting that the brain generates predictions about the external world based on past experiences and updates these predictions based on mismatches (prediction errors) between the predictions and actual sensory input. Autism spectrum disorder (ASD), a neurodevelopmental condition characterized by sensory hypersensitivity and difficulties in social communication, has been hypothesized to involve abnormalities in the predictive coding process. However, the exact nature of these abnormalities in ASD remains unclear. In this study, the neural mechanisms and abnormalities of predictive coding in auditory responses were investigated using valproic acid (VPA)-exposed autism model marmoset. Using electrocorticography (ECoG) with 96–128-channel electrodes placed to cover the entire lateral surface of one cerebral hemisphere, we recorded brain activity while the marmosets were exposed to auditory stimuli of varying probabilities. The results revealed that, in autistic marmosets, the brain's predictions about repetitive auditory stimuli were less stable compared to neurotypical marmosets. Furthermore, individual differences were observed in how predictions were utilized: one autistic marmoset relied excessively on predictions, prioritizing them over actual sensory input, while the other struggled to integrate predictions effectively, making it difficult to appropriately combine predictions with sensory information. These findings provide new insights into the neural mechanisms underlying autism and pave the way for the development of personalized support and therapeutic interventions tailored to the unique symptoms of each individual with ASD. This study was conducted in collaboration with Dr. Zenas Chao, Associate Professor at the International Research Center for Neurointelligence, The University of Tokyo; Dr. Misako Komatsu, Specially Appointed Associate Professor at the Institute of Innovative Research, Institute of Science Tokyo; and Dr. Noritaka Ichinohe, Director of Ultrastructural Research, National Institute of Neuroscience, National Center of Neurology and Psychiatry.

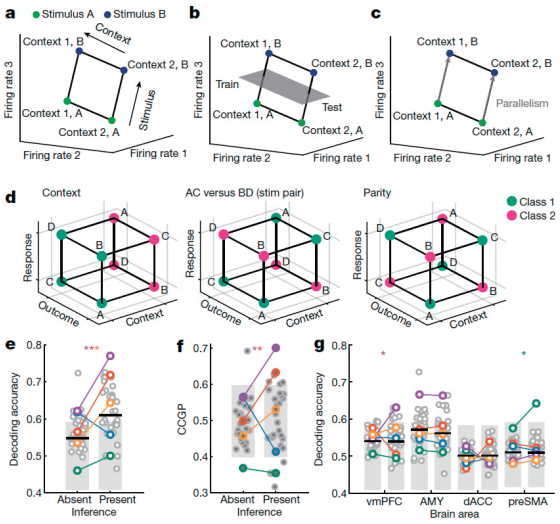
“Erroneous predictive coding across brain hierarchies in a non-human primate model of autism spectrum disorder.” Zenas Chao, Misako Komatsu, Madoka Matsumoto, Kazuki Iijima, Keiko Nakagaki, Noritaka Ichinohe Communications Biology doi: 10.1038/s42003-024-06545-3

3-3 Neuronal ensembles in the hippocampus flexibly represent abstract contexts as needed



Principal Investigator (PI)
Ralph Adolphs
California Institute of Technology Bren Professor of Psychology, Neuroscience, and Biology

We recorded from single neurons in the brains of neurosurgical patients to study how “joy” and “aspiration” may be represented in the human brain. The patients saw pictures of faces and other stimuli while they had to perform changing tasks. We applied representational geometry methods to analyze the populations of recorded neurons. We found that neurons in the hippocampus can represent abstract variables, such as the task context, but only if patients are able to infer the task, or are told the task (Figure). The findings show how flexible and abstract knowledge in the human brain can be represented by populations of neurons.



"Abstract representations emerge in human hippocampal neurons during inference behavior." Hristos S. Courellis, Juri, Minxha, Araceli R. Cardenas, Daniel Kimmel, Chrystal M. Reed, Taufik A. Valiante, C. Daniel Salzman, Adam N. Mamelak, Stefano Fusi, Ueli Rutishauser. Nature 632:841-849, 2024. doi: 10.1038/s41586-024-07799-x

4-1 Quantifying the "sensation of dry throat when eating dry food"

Principal Investigator (PI)
Hiroshi Yamada
University of Tsukuba,
Institute of Medicine
Associate Professor

When we eat foods with little moisture, such as rice crackers or cookies, our throats become dry. Why does this happen? Thirst and hunger are subjective sensations occurred by the brain, but they have many different causes. For example, eating herring roe makes you want to drink something because of the high salt content. Likewise, eating cookies makes your mouth dry, so you want to drink tea. In this way, decisions about what to eat and drink are regulated according to the state of your body. In technical terms, thirst and hunger are related to homeostasis in the body, and are physiologically regulated so that a constant state of the body is maintained. But when we feel thirst or hunger, are these actually happening inside our bodies in the way that we feel them?

In this study, we used macaque monkeys (Japanese macaques and rhesus monkeys), the experimental animals that are closest to humans and are able to regulate their eating and drinking habits, to quantitatively measure whether eating dry food causes thirst. It is known that thirst correlates well with blood osmotic pressure, and hunger is well reflected by ghrelin, a hormone secreted from the stomach. We took blood samples and measured the changes in osmotic pressure and ghrelin before and after feeding the macaques dry crackers (a type of hardtack) that they normally eat. The results showed that osmotic pressure and ghrelin closely corresponded with the changes in thirst and hunger levels (Figure 1). Eating and drinking are essential for maintaining a healthy life. The results of this research are expected to be useful in evaluating diseases related to abnormalities in appetite such as thirst and hunger (e.g., depression).

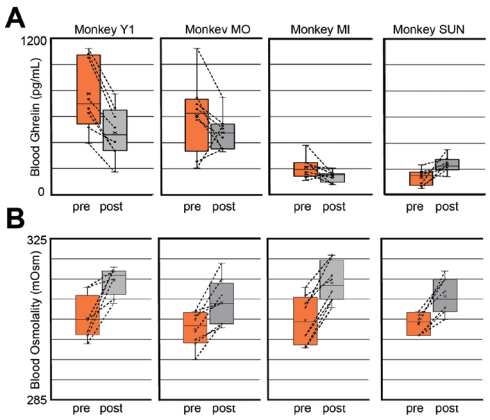


Figure 1. Blood osmolality and ghrelin concentrations before and after eating dry food
(A) After eating dry food, blood ghrelin levels decreased in three of four monkeys, closely reflecting abdominal distension. (B) Blood osmolality increased in all monkeys after eating dry food, reflecting their thirst. These indices showed changes that corresponded well with the monkeys' water intake and food intake.

A Method for Evaluating Hunger and Thirst in Monkeys by Measuring Blood Ghrelin and Osmolality Levels. Suwa Y, Kunimatsu J, Kamata A, Matsumoto M, Yamada H. eNeuro. 2024 11(8):ENEURO.0481-23.2024. doi: 10.1523/ENEURO.0481-23.2024. Print 2024 Aug. PMID: 39013584.

Award

Dr. Oguchi received the Excellent Poster Award at the 23rd Winter Workshop on "The Mechanisms of the Brain and Mind."

From January 9 (Tuesday) to January 11 (Thursday), 2024, the 23rd Winter Workshop on "The Mechanisms of the Brain and Mind" was held at Rusutsu Resort in Hokkaido. During this workshop, Dr. Mineki Oguchi's poster presentation,
"Differences in the neural basis of charitable decision-making between proself and prosocial individuals," was awarded the Excellent Poster Award.