Issue: 02

Humanity

THE TECHNOLOGY REPORT_

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Special Feature: Humanity

The "Human" as a Compound of Body and Tool

It can be said that human society has evolved by pursuing "convenience". But what exactly is "convenience"?

For example, using a car, you can reach a destination in a few hours, a journey that would take several days on foot. This is one form of "convenience". In this case, the car acts as an entity that "extends" human capabilities. Various tools exist in human society, and many of them serve to extend human abilities and bring convenience in this way.

The pursuit of "convenience" means making possible what humans previously could not do. Human life has changed with technological advancement. In the modern era, where the pace of technological progress is rapid, changes in human life also occur swiftly. But is it only human life that has changed?

Decades ago, people often remembered their family and friends' phone numbers. Now, there is no need to remember them as they are stored in mobile phones. Humans have delegated the task of "remembering phone numbers" to machines. Mobile phones, which memorize contact information on our behalf, may have almost become part of the human body. It goes without saying that modern humans rely on mobile phones for much more than just contact information. Could we even go so far as to say that we, who carry our mobile phones with us at all times, are augmented humans, a composite of tools and body? The advancement of technology might be bringing about changes not just in our lives but in us humans ourselves.

In this edition of THE TECHNOLOGY REPORT, we will explore the changes in humans brought about by tools. Will we achieve a world without inequalities through the augmentation and generalization of our capabilities? Or, conversely, will disparities widen? As technology evolves, how will humans transform themselves?

Throughout history, tools have always transformed our lives. They enable us to do things we couldn't before, and once that becomes the norm, new conveniences are invented. In this way, our very selves have also changed. But what exactly about us has changed, and how?

The Modern Era of Human-Machine Integration

Humanity has lived alongside tools throughout its history. In the Stone Age, stone tools were used as extensions of the hand, and the invention of the wheel replaced our reliance on our feet, helping us travel long distances. With the advent of computers, we initially delegated some of our calculations, and eventually, even our memory and thought processes. We are now living in an era of unprecedented integration between humans and tools.

When we think of the integration of tools and the body, wearable tools often come to mind first. Glasses and contact lenses, which can correct vision, are the most obvious examples. Clothing, protecting us from heat and cold, can also be viewed as a tool for regulating body temperature. These tools are designed with "wearability" in mind, achieving integration with the body.

On the other hand, there are tools that, despite having a completely different form from the human body, can still feel like extensions of it. Vehicles such as as bicycles, motorcycles, and cars are examples of this. Often referred to as "one's legs" in Japan, these tools achieve a sense of integration with the body.

You may have heard of the term "unity of rider and horse" (人馬一体). This term refers to skilled equestrians who seem to become one with their horses, suggesting the relationship between the human body and tools. Tools that are easy for humans to wear or manipulate have the potential to achieve a sense of integration with the body. This is not "unity of rider and horse", but rather "unity of

Junichi Rekimoto, an advocate of human augmentation technology, states that Robert Hooke, the developer of the optical microscope, was the first to clearly articulate that technology and tools extend human capabilities. Hooke considered the microscope to be an extension of vision, and stated, "There may be found many mechanical inventions to improve our other senses, of hearing, smelling, tasting, touching."

This term, often used in exploring the relationship between machines and humans, dates back to the 1980s. Yamaha Motor Co., Ltd. named their approach to harmonizing and integrating riders with their bikes during their Paris-Dakar Rally challenges as "Humachine (Human-Machine Integration) Technology". In the field of research, Katsuya Kanaoka of Ritsumeikan University, Takayuki Furuta of Chiba Institute of Technology, and Masahiko Inami of The University of Tokyo have each explored the possibilities of harmonizing people and machines under the banner of "human-machine integration".
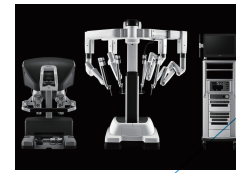
A robot assisting in endoscopic surgery. It features arms with wrists (forceps), equipped with tools enabling the operator to perform tasks including suturing. The imaging component uses a stereo camera, allowing for three-dimensional visualization and zoom, enabling the capture of small areas difficult for human eyes to see. *1

Neil Harbisson's embedded sensor cannot be removed, so his passport photo includes the sensor, leading to him being referred to as a "government-recognized cyborg" by the UK. *2

human and machine". In modern times, technological advancements have led to the miniaturization of various tools, making them easier to wear. Additionally, advancements in sensing and control technologies have improved usability and expanded the situations in which they can be used. Due to these technological backgrounds, the number of tools that can achieve "human-machine integration" around us continues to increase.

Let's consider a few examples. AirPods Pro, once set up, can be worn in the ears with barely any awareness of their presence, allowing noise cancellation and communication. They represent human-machine integration through their ease of wearing and effortless control.

The surgical assistance robot da Vinci was developed to enable complex surgery. Its robotic arms can precisely replicate the movements of a surgeon's hands. This integration of doctor and robot allows for meticulous surgery while minimizing the impact on the patient's body.

Contemporary artist Neil Harbisson can "hear" colors. Born with congenital color blindness, at the age of 21, he underwent surgery to embed an antenna into his skull. This antenna converts the frequencies of colors into sound. These sounds are then transmitted through the mechanism of bone conduction as vibrations to the skull. Thus, Harbisson can perceive colors as sounds. The sounds he hears can be transmitted to a PC via Wi-Fi, allowing others to listen to them. This is a new pattern of communication born from human-machine integration, where colors can be shared audibly with others.

Changing the Definition of "Presence" in an Information Environment

As we increasingly integrate with various tools, we are also transforming the very definition of "existence". Once, having a conversation meant being face-to-face with someone. However, since the invention of the telephone, "meeting" and "talking" have become distinct actions. A similar shift is now happening to our sense of "being present" driven by the proliferation of remote working and social networking services (SNS).

The COVID-19 pandemic changed how people work. With video conferencing systems and groupware, work can progress without the need for physically going to an office. It's possible to collaborate as if in the same room, while maintaining temporal and spatial freedom. We feel the presence of others simply by seeing online status indicators or the "..." symbol indicating someone is typing a message.

The technology that provides a sense of presence as if users were face-to-face is called "telepresence technology". Currently, it is heavily reliant on visual and auditory elements, like video conferencing, but with the advancement of sensing technology, it's thought that meetings that feel "truly present" will become possible.

Horizon Workrooms, a virtual meeting system developed by Meta, utilizing VR headsets, is one example. Users wear VR headsets and log into a 3D CG-constructed virtual space. This space captures elements related to "presence", such as the direction of a user's face, their voice, and simple gestures,

Gather is an evolutionary example of the typical meeting app. In Gather, users first create a virtual space resembling a regular office, then create characters to log into this virtual space. When characters come close to each other or enter the same meeting room, their microphones activate, allowing them to be heard by others. By preparing characters and locations, the app aims to emphasize the feeling of "being there". *3

This technology creates the sensation that someone in a remote location is actually present. Its first mention comes from the 1942 science fiction novel "Waldo" by Robert A. Heinlein. The idea from this novel inspired American cognitive scientist Marvin Minsky to propose the concept. There's a similar term, "telexistence", which encompasses a broader concept, including existence in virtual spaces.

The reason why meetings on Horizon Workrooms can feel "as if you are there" is due to the presence of avatars and their ability to reflect various gestures of the users. Hand movements are said to play a particularly important role in communication, and Workrooms senses these movements through controllers and IR cameras, reflecting them in the avatars. *4

The concept of ambient intimacy was proposed by designer Leisa Reichelt. She particularly used this term in the context of Twitter, but it can be argued that ambient intimacy is also felt in other social networking services.

making partial non-verbal communication possible, just as it is in daily life.

Even before the widespread adoption of remote working, social networking environments had permeated our lives. Haven't we been closely following the lives of distant friends through social media when it comes to details like a recent breakup, a newfound passion for a new video game, or even what they had for lunch that day? This sense of closeness created by the information environment is referred to as "ambient intimacy". Interaction through social media has become an integral part of our real lives, creating a sense of "being together" with people who are physically far away.

By wearing tools or mastering their use, the boundaries between our physicality and these tools are becoming blurred. It's a situation where pure tool and pure human physicality intermingle. As this active extension by tools progresses, the definitions of our body and our sense of presence may be rewritten.

So far, we have examined the current state of integration between our bodies and tools and how it is rewriting our perceptions. In the next chapter, we will explore the possibilities of our evolution by looking at more examples that extend various senses and functions.

Tools as the "Seeds of Evolution"

Major References:
"I listen to color", Neil Harbisson, TED, 2012, accessed August 29, 2022
https://www.ted.com/talks/neil_harbisson_i_listen_to_color
"インテュイティブジャパン | ダビンチロボット支援手術システム", Intuitive Surgical, accessed August 29, 2022
https://www.intuitive.com/ja-jp
"「Horizon Workrooms」を発表：リモートでの共同作業を再構築", Meta, accessed August 29, 2022
https://about.fb.com/ja/news/2021/08/horizon-workrooms/
"Ambient Intimacy", Leisa Reichelt, disambiguity, accessed August 29, 2022
http://www.disambiguity..com/ambient-intimacy/

Image Sources:
*1 "インテュイティブジャパン | ダビンチロボット支援手術システム", Intuitive Surgical, accessed August 29, 2022
https://www.intuitive.com/ja-jp
*2 "色に恋したサイボーグ、ニールハービソンが問う「人間の条件」", WIRED, Condé Nast Japan, accessed August 29, 2022
https://wired.jp/2018/01/01/neil-harbisson-interview/
*3 "Gather | Feel like a team again", Gather Presence, Inc., accessed August 29, 2022
https://wwwgather.towni/
*4 "Workrooms | ビジネス会議用VR", Facebook Technologies, LCC., accessed August 29, 2022
https://www.oculus.com/workrooms/?locale=ia

You can refer to this collection of references, including the sources introduced in "From Tools that Supplement to Tools that Augment", as well as related examples that could not be fully covered in the print edition, via the 2D code on the right.

So far, we have traced the history of how we have transformed ourselves through the use of tools. From here, we will delve into the latest technologies currently under development and contemplate how they might shape our future.

Tools that Augment Our Senses

Throughout history, we have continually reshaped ourselves with the use of tools. With the miniaturization of various devices and the widespread availability of communication technologies, a series of wearable tools that enhance our physicality are being developed. How will human beings evolve as we coexist with these cutting-edge technologies? Let's explore this through the lens of our five senses.

First, let's discuss vision. In the previous section, we introduced how glasses and contact lenses function as tools that integrate with the human body. Moving forward, we will delve into technologies that augment our physicality in a broader sense. The first example is a contact lens that projects images directly onto the retina.

Mojo Vision is developing a smart contact lens called Mojo Lens. According to the company's announcement, this lens is equipped with a micro-LED display with a resolution of 14,000 pixels per inch. It also features 5GHz wireless communication capabilities, aiming to offer wearers an augmented reality (AR) experience by displaying information directly in their line of sight. The displayed information can be controlled using the wearer's gaze.

In the realm of hearing, the advancement of tools has produced remarkable results. Oticon's hearing aids, which can be used in conjunction with smartphones, have capabilities that allow users to focus on specific sounds for clearer hearing or,
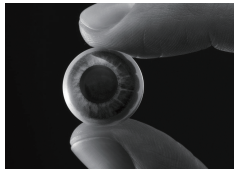
A contact lens-type device that became a topic of discussion on social media around July 2022. At first glance, it appears to face many technical challenges, but given its consistent announcements of research findings in various fields like batteries and communication, its regular unveiling of functional prototypes, and the fact that the CTO himself is a test subject, it's believed they've undoubtedly made something operational. However, it's unclear if it performs as per the catalog specifications yet. *1

With smartphone integration, it's now possible to connect the hearing aid with external devices. Features include hands-free calling when connected to a phone's calling function, audio streaming when linked to a TV, and with the use of IFTTT (If This Then That), one can receive notifications for things such as a doorbell ringing even when upstairs or get alerts for laundry completion or oven cooking directly through the hearing aid.
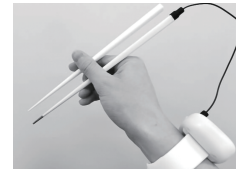
Joint research by Meiji University and Kirin Holdings. It amplified the saltiness by 1.5 times using a gel mimicking general food. This holds future promise, especially for people who must adhere to low-sodium diets due to hypertension, etc. *2

Participants wear a head-mounted display (HMD) and see a picture of a different type of cookie while they eat. A different scent is also emitted from an olfactory display. Consequently, they end up tasting a flavor different from the actual cookie they are consuming. *3

PossessedHand® controls finger movements by electrical stimulations through electrodes attached on muscles, making it feel like being possessed by another person's movement. FirstVR is a combination of an HMD and a myoelectric gesture controller. They aim to enable the mutual sharing of physical sensations with real or fictional others.

conversely, to shut out particular noises. Such adjustments are hard to achieve with the human ear alone.

How about the sense of taste? Chopsticks that enhance saltiness by 1.5 times through electrical stimulation would likely be warmly welcomed by those tired of low-sodium diets. Of course, there are approaches beyond just the taste of salt. In an experiment using a system called "Meta Cookie", sensory interactions between vision, smell, and taste were harnessed to alter the perceived flavor of a plain cookie. Over 70% of the participants who underwent this experience felt they were actually tasting strawberry or chocolate.

A relatable advancement in the realm of touch would be the "vibration feature to notify incoming calls on smartphones". Nowadays, we can perceive a notification just by detecting a vibration in part of our body.

Technology that transmits gestures from person to person is also advancing. The BodySharing® (Shared Experience) system proposed by H2L, aims to offer experiences like downloading the movements of a piano maestro and letting them "possess" one's hand. It does this by combining muscle displacement sensing technology with human body control through electrical stimulation.

Seeing, hearing, tasting, smelling, touching. The evolution of tools associated with our five senses is gradually reshaping these very actions.

A New Body with Six Fingers and Cat Ears

The key to the integration of tools and the body lies in "brain plasticity". Brain plasticity refers to the property by which the structure and function of neural circuits change in response to neural activity. Because of this property, we are able to remember things, learn, and become proficient in using tools.

Thanks to the power of this brain plasticity, as the brain becomes accustomed to a "new physicality" augmented by technology, tools start to be recognized seamlessly as a part of the body. There are countless tools that can function in the gap between the external world and the physical body: cars, musical instruments, a sixth finger, cat ears, and even arms in virtual reality spaces. Humans incorporate these tools into their being and operate as if they are part of the body through a "unity of human and machine".

The "sixth finger" project, which artificially adds a sixth finger, is a prime example that demonstrates the embodiment of tools through brain plasticity. Subjects who operated the prosthetic finger for about an hour showed changes in sensation and behavior that occurred when they felt this finger to be "part of their own body". The fact that they were able to perceive and control a body part that reflected neither their natural-born physical shape nor that of a familiar other suggests that we have the potential to design our physicality at will.

We've also reached a point where we can embody "nekomimi (cat ears)", which used to be an imaginary concept. Necomimi measures the brain's
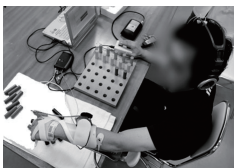

Brain plasticity is also utilized in rehabilitation. Patients who have suffered a stroke and consequently experience hemiplegia (paralysis on one side of the body) can sometimes forget how to move their body. During rehabilitation, using Brain-Machine Interfaces (BMI) and EEG to measure brain waves and muscle movement has been shown to significantly improve rehabilitation outcomes. *4
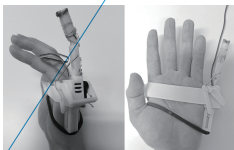
A project that adds a sixth finger to observe changes in body sensation and more. This project investigates the electrical signals in the arm muscles, and -unlike traditional research- allocates signals different from those for "moving five fingers" to the sixth finger, which enables more natural control. As a result, as expected, the sixth finger received a subjective evaluation of being "a part of one's own body". This suggests that when the body is augmented, the sense of one's own body, or embodiment, can be augmented as well. *5

Introduced in 2011 and commercialized the following year, necomimi is a cat-ear shaped communication tool. It measures brain activity using sensors placed on the forehead and expresses the user's state by moving the cat ears on their head. For the history of its development, refer to the column on page 22.
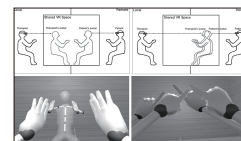
The "Phantom Limb Pain VR Therapy System", which won the Good Design Award in 2021, aims to address the limitations of distance and time. Even if the therapist and patient are not in the same room, therapy can be conducted in VR. By reproducing the sensed real-world movements of the shoulders, elbows, wrists, and five fingers in a virtual space, the system aims to provide a sensation as if both participants are in the same location. *6

state using sensors and provides feedback in the form of moving cat ears attached to a headband. The cat ears move according to the estimated "level of concentration" or "level of relaxation". This can be seen as a new tool that not only updates the image of the body but also enhances non-verbal communication elements.

Lastly, let's mention an approach that directly targets our senses in the context of altering our body and self-image.

The phenomenon where a person feels pain in a body part that shouldn't exist or was lost due to injury or illness is called "phantom limb pain". This condition is believed to arise when the brain cannot adapt to the loss of a limb. In the 1990s, American neuroscientist V. S. Ramachandran successfully alleviated phantom limb pain using visual feedback. This approach, which at the time employed a device called a "mirror box", has since been integrated into the field of VR. Masahiko Sumitani, who researches cognitive neuro-robotics at the University of Tokyo, revealed that virtual phantom limbs in VR are particularly effective in alleviating phantom limb pain associated with the sense of movement. Recently, products have been introduced that connect therapists with phantom limb pain patients remotely. The "alternate reality" created by VR tools can, in some cases, modify real-world pain.

We possess the potential to recognize any tool as "a part of our own body". Possessing four arms, six fingers, and communicating while moving cat ears might just become one of the many standard forms of diversity in the near future.

Major References:

"We Have Reached A Significant Development Milestone with Mojo Lens", The Mojo Blog, accessed August 29, 2022
https://www.mojo.vision/news/we-have-reached-a-significant-milestone-blog
"オーティコン ON アプリ 補聴器用スマホアプリ｜オーティコン補聴器", Oticon, accessed August 29, 2022
https://www.oticon.co.jp/hearing-aid-users/hearing-aids/lineup/on-app
"感覚相互作用を用いた味覚ディスプレイの検討", Narumi Takuji, Tanikawa Tomohiro, Kajinami Takashi, Hirose
Michitaka, Journal of the Virtual Reality Society of Japan Vol.15 No.4 , 2010
"H2L; Happy Hacking Life", H2L, Inc. , accessed August 29, 2022
http://h2l.jp/
"MetaLimbs", INFORMATION SOMATICS LAB, accessed August 29, 2022
https://star.rcast.u-tokyo.ac.jp/metalimbs/
"脳波で動く、ネコのミミ。『necomimi』", NeuroSky Co., Ltd, accessed August 29, 2022
https://www.neurosky.jp/necomimi-new/
『脳の中の幽霊』, V. S. Ramachandran Sandra Blakeslee, Kadokawa Shoten, 1999
"バーチャルリアリティ治療で緩和される幻肢痛の特徴：痛みの性質に基づいたオーダーメイド医療の可能性をバー
チャルリアリティで確認", The University of Tokyo, accessed 29 August 2022
https://www.u-tokyo.ac.jp/focus/ja/articles/z0508_00104.html

Image Sources:
*1 "Mojo Vision", Mojo Vision, Inc., accessed August 29, 2022
https://www.mojo.vision/
*2 "電気刺激によって塩味を 1.5 倍増強させることに成功：箸型デバイスを開発 明大とキリン", fabcross for
engineer, MEITEC CORPORATION, accessed August 29, 2022
https://engineer.fabcross.jp/archeive/220412-meiji-univ.html
*3 "Webpage of Takuji Narumi", Takuji Narumi, accessed August 29, 2022
https://www.cyber.t.u-tokyo.ac.jp/~narumi/metacookie.html
*4 "Feasibility of task-specific brain-machine interface training for upper-extremity paralysis in patients with
chronic hemiparetic stroke", Nishimoto et al., "Journal of Rehabilitation Medicine", 2018
*5 "体は機械で拡張できる！？「第６の指」独立で動かすことに成功 電通大", Science Portal, Japan Science and
Technology Agency, accessed August 29, 2022
https://scienceportal.jst.go.jp/gateway/clip/20220315_g01/
*6 "「幻肢痛 VR 遠隔セラピーシステム」が 2021 年度 グッドデザイン賞を受賞", Information Services
International-Dentsu, Ltd., accessed August 29, 2022
https://www.isid.co.jp/news/release/2021/1021.html

Tools for Designing the "New Us"

You can refer to this collection of references, including the sources introduced in "Tools as the 'Seeds of Evolution'", as well as related examples that could not be fully covered in the print edition, via the 2D code on the right.

So far we have looked at the potential for our sense of embodiment to change due to the brain's plasticity adapting to tools. Conversely, when the external environment itself changes due to certain tools, how might our sense of embodiment and abilities transform?

VR as a Tool for Swapping Environments

We can describe VR as a tool that allows us to swap environments. So, what happens when we're in a different from usual environment? Insights can be found in real-world examples.

The Guugu Yimithirr language doesn't have words "front, back, left, right". Instead, spatial relations are conveyed using directions like "north, south, east, west", requiring speakers to always be aware of their orientation. A scientist who spent time locally said that "one day a small window, like the ones in video games, appeared in my mind". Similar to this case, experiences in virtual spaces can sometimes affect our cognition and abilities in reality.

For instance, there's the "Kendama Dekita! VR" in which beginners practice the kendama (a Japanese toy) in a VR space. After doing so, they found they could handle a real kendama better. In this VR environment, the ball starts moving slowly and gradually approaches the speed of a real kendama. This practice, which is unique to the VR environment, has helped more than 90% of the participants improve their kendama skills.

A collaborative research project by YCAM and Sony CSL reports, dancers wearing VR headsets were shown their own avatars that moved just slightly ahead of their actual movements then felt as if their bodies became "lighter".

In a study conducted by the University of Barcelona, participants who used an avatar resembling Einstein in a virtual space demonstrated higher
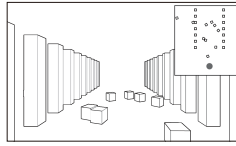
Cognitive scientist Lera Boroditsky spent time in a community in northern Queensland, Australia, that uses the Guugu Yimithirr language. About a month into her stay, she felt as though a window appeared in her mind. She described herself as "a small red dot on an aerial view", and when she "changed direction, the small window changed direction too". When Boroditsky shared this discovery with the locals, their response was, "Of course, how else would you do it?"

Similar efforts exist to adjust physical constraints in VR for optimized motor learning. It's said that when humans perceive an object and move accordingly, there's a delay ranging from several tens to 100+ milliseconds. Such delays can be detrimental in many sports. Therefore, it's said that humans construct predictive models of object movement for rapid motion control. VR may contribute efficiently to the formation of these models. *1

Using motion capture suits etc., body movements are majored. Past or future movements are presented to participants through a head-mounted display. When shown their movements from the near past, people felt as if their bodies were "heavier". When shown movements not from the near past or future, no similar sensory changes occurred.

"Babiniku" (the term making an analogy of "incarnation") is an internet meme referring to the act of using a beautiful girl avatar in VR spaces. Individuals of various physical genders and identities engage in "Babiniku". The cited paper specifically discusses cases where individuals with male physical gender participate in this culture.

The sensations acquired through phantom sense vary including tactile senses, and senses of temperature or wind. Furthermore, there is already a culture within the VR community called "Osatou (sugar)", which refers to engaging in romantic relationships in the virtual world. It is presumed that such a foundation has nurtured the culture of virtual sex.

cognitive performance than those who used regular avatars. Such an approach of modifying body image and enhancing cognition through tools, including avatars, is referred to as "Ghost Engineering".

Ghost Engineering might even offer the possibility of reconstructing human gender. It has been pointed out that avatars can be a means to escape from the masculinity in reality. According to anthropologist Liudmila Bredikhina, the motivation behind "Babiniku" is to find refuge from real-world masculinity, and to be allowed to express vulnerability, dependence on others, and behave attractively.

A phenomenon called virtual sex has also emerged. According to VTuber "Virtual Bishojo Nem", who live-streamed virtual sex, the essential components of virtual sex lie in the ability for emotional immersion and the "VR sensation (phantom sense)". VR sensation is closely related to the concept of cross-modal phenomena in cognitive science. "Meta Cookie", introduced in the previous chapter is another instance of the cross-modal phenomenon, changing taste by combining vision and olfaction.

From kendama to dancing, from Einstein to virtual beautiful girls, we've looked at various examples. It seems they all gain something new when entering the VR space. By replacing the environment itself with VR, technical skills can improve rapidly, and new bodily sensations can flourish.

Questioning the Ethics of Tools

Humans are creatures that change through experiences. Many might recall the feeling of leaving a movie theater and sensing the world differently than before they went in. VR offers similar experiences, akin to those movies. This experience is intricately connected to human cognition. The tools we've discussed, which augment our sense of embodiment, and "ghost engineering" through VR technology, hint at the possibility of editing human nature itself.

There are voices that claim their personalities have been altered due to VR; that their "VR personality" seems to erode their "real-life personality". This too suggests the potential for engineering human nature. However, not all aspects of this are positive. We are at a stage where we should carefully contemplate the ethical aspects of technologies which augment human nature.

In a society where human nature can be manipulated through engineering, our core beliefs, even those concerning life and death, might change. The sci-fi comedy drama "UPLOAD", launched on Amazon Prime Video in 2020, depicts a world where after death, a consciousness   can be uploaded into a virtual space. This concept of a "virtual heaven" was received by those living in 2022 with a certain degree of realism. Given the advancements in virtual technology, the world of "UPLOAD" doesn't seem entirely far-fetched. However, just a decade ago, this show would likely have been perceived as a product of wild imagination.

A concept proposed by Takashi Narumi. It refers to an engineering framework that augments cognition based on physical transformation. As an example, during online meetings, artificially augmenting one's facial expression to appear more cheerful can lead to a 1.5 times increase in ideas during brainstorming sessions. There are several instances where self-perception can change one's abilities.

A science fiction comedy drama. The narrative depicts a world where, after death, one's consciousness can be uploaded to a virtual space. It raises questions about how socio-economic disparities and legal systems might impact the afterlife, what the role of the managing company should be, and what distinguishes a consciousness-only human from an AI beginning to develop its own personality.

2016 was dubbed the "Year of VR". However, in 2012, ten years prior to the publication of this issue, VR products were available to the public, but they weren't something you could easily purchase at general electronics retailers. Furthermore, when VR products were depicted in visual media, they were often set in a distant future. Had we watched "UPLOAD" back then, we might have perceived it as a low-budget production with futuristic gadgets but not a futuristic setting.

After her passing, the blog was maintained by her parents. Fans not only visited to read the celebrity's past blog entries but also engaged in various activities like expressing their admiration for her, giving updates about their own lives, interacting with other fans, and reading comments other fans had addressed to the celebrity. Through these interactions, fans seemed to continue to sense her presence and intimacy.

Users can set up instructions for their accounts in the event of their death. Once an account is memorialized, the word "Memorial" appears next to the profile name. Other users can share their memories of the deceased, in the form of photos or text, on the memorial timeline for other users to see.

In the first chapter, we introduced the concept of "Ambient Intimacy", a closeness brought about by the information environment, including social media platforms. Such modes of communication also influence our perceptions and beliefs about life and death. For instance, many continued to visit the blog of celebrity Ai Iijima, despite her untimely passing in 2008. By the time it was closed in 2015, the blog had received over 70,000 comments, with some remarking, "By coming here, it feels like I can meet Ai-chan".

On Facebook, when a user passes away, their account can be converted into a memorial account. The policy clearly states, "Memorialized accounts are a place for friends and family to gather and share memories after a person has passed away".

We have constructed tools and environments using technology, subsequently reshaping our humanity. Among the emerging technologies, some might radically alter our perspectives or bring about significant rule changes. While some changes might be favorable, others might be more challenging to welcome. Nevertheless, the momentum of change is accelerating. In this rapidly evolving landscape, we need to be conscious of what kind of evolutionary seeds the tools we're creating today will sow. Those involved in technology now bear responsibility not only for convenience but also for the potential societal, cultural, and human impacts of the changes they usher in. How will we adapt and change? We need to be prepared with answers to these questions.

Major References:
『進化を超えさせる進化　サピエンスに人類を越境させた４つの秘密』, Gaia Vince, Bungei Syunju, 2022
"けん玉初心者がVRで特訓、９割が現実でも「できた」驚きのVRゲームが生まれたワケ", Yamaguchi Keisuke, ITmedia NEWS, accessed August 29, 2022
https://www.itmedia.co.jp/news/articles/1809/04/news029.html
"Malleable Embodiment", Sony CSL, accessed August 29, 2022
https://www.sonycsl.co.jp/tokyo/3969/
""バ美肉"テーマの論文がジェンダー分野の学術賞を受賞する。バーチャル美少女になる人々は何を実践しているのか", Yuki Kurosawa, AUTOMATON, accessed August 29, 2022
https://automaton-media.com/articles/newsjp/20220526-204110/
"「バーチャルセックス」体験したらすごかったし人類を滅ぼしかねないと思った話　【バーチャル美少女ねむの寄稿】", Virtual Bishojo Nem, Netlab, accessed August 29, 2022
https://nlab.itmedia.co.jp/nl/articles/2105/31/news141.html
"Virtually Being Einstein Results in an Improvement in Cognitive Task Performance and a Decrease in Age Bias", Domna Banakou, Sameer Kishore, Mel Slater, Frontiers, accessed August 29, 2022
https://www.frontiersin.org/articles/10.3389/fpsyg.2018.00917/full
"マツコ メタバースで出会った女性と結婚した男性の言葉に納得「煩わしさがない」", Matsuko Kaigi, NTV, accessed August 29, 2022
https://www.ntv.co.jp/matsukokaigi/articles/6zslmvi2fxr4aflta.html
"亡くなった芸能人ブログで続く"大切な交流"書き込みが癒しに：「ここに来れば愛ちゃんに会える」", withnews, accessed August 29, 2022
https://withnews.jp/article/f0201206000qq000000000000000W0e110201qq000022150A

Image Sources:
*1 "けん玉できた！VR"，Ima Create Co., Ltd，accessed August 29, 2022
https://prtimes.jp/main/html/rd/p/000000033.000034298.html
*2 "Malleable Embodiment"，Sony Computer Science Laboratories, Inc.，accessed August 29, 2022
https://www.sonycsl.co.jp/tokyo/3969/
*3『アップロード：デジタルなあの世へようこそ』, Amazon.com, Inc., accessed August 29, 2022
https://www.amazon.co.jp/gp/video/detail/B08BYYG3SP/ref=atv_dp_share_cu_r

You can refer to this collection of references, including the sources introduced in "Tools for Designing the 'New Us'", as well as related examples that could not be fully covered in the print edition, via the 2D code on the right.

Commentary: Prosthetics and Human Augmentation   *By: Ryusuke Izumida*

Prosthetics have a long history. There are records concerning prosthetic legs as early as the 12th century BC. In the 19th century, the development of mechanical prostheses and the increase in amputees due to WWI and WWII led to a major evolution of prostheses. By 1945, electric prosthetic hands were introduced, and by 1955, myoelectric prosthetic hands made their debut, leading us to the present day. So, what is the current state of the prosthetics world today? Let's explore it from a technological perspective.

Ottobock, a German company that is the world's leading manufacturer of prosthetics, has developed the MyoPlus system for myoelectric prosthetic hands. It enables intricate movements such as the opening and closing of fingers and the twisting of the wrist. In the area of powered prosthetic legs, Japanese startup BionicM has developed Bio Leg. By using a motor to assist, it makes actions like climbing stairs more natural than before.

There are also initiatives to make prosthetics more affordable and accessible. Instalimb is offering their prosthetic legs at one-tenth of the conventional price by developing specialized 3D printers and software for creating prosthetic legs. exiii introduced HACKberry, an open-source myoelectric prosthetic hand. 3D data for parts, electronic circuit data, source code, etc., are available for anyone to access. Using a 3D printer, one can obtain a myoelectric prosthetic hand for roughly 50,000 yen in material costs.

Lastly, let's introduce initiatives that aim to surpass the abilities of non-disabled individuals through the power of technology. "Project for BLADE RUNNER" by PARA-SPORTS LAB. is a research project in which a prosthetic-legged runner targets breaking the men's 100m world record. Currently, there's a roughly one-second gap between the two. Various research is being conducted to fill this gap and improve the performance of para-athletes.

For prosthetics to be more seamlessly used as if they were a natural part of the body, technology is essential. And these technologies are evolving prosthetics into "human augmentation tools" that enable capabilities beyond the traditional human body.

Commentary: Exploring Bio-signals and Human Augmentation   *By: Kana Nakano*

In 2009, iPhone 3GS was released in Japan, and I was on the hunt for what might come after the smartphone, with a mission to develop "a new form of communication to come". In the fall of that year, I discovered NeuroSky's brainwave sensor. When worn, it visualizes your brainwaves in real-time. This experience, akin to witnessing one's consciousness being projected outside of oneself, intrigued me. I decided then to design an entirely new communication device utilizing this technology. A design that would comfortably fit on the head for brainwave measurement, and a simple yet clear representation of the majored data.
The idea that sprouted was "cat ears that move in response to brainwaves". Instead of using the brainwaves to "control" like traditional BMIs, we can employ them to unconsciously "express" the wearer's brain state, and the device would become a human's new "communication organ".

In 2011, we developed the prototype, and held some demos. Observing one's brain state being "exposed" through the cat ears was almost certainly a first-time experience for many. Most participants ended up laughing out loud. An individual's ears perked up when they received a notification, a couple's ear slowly synchronized as they conversed, and celebrities remain "relaxed" even in front of a camera. This prototype garnered international attention, leading "necomimi" to be chosen as one of TIME Magazine's "50 Best Inventions". The product was commercialized in 2012 and 2021.

As I continued demos, I found that I could control the movements of the necomimi to some extent. At Ars Electronica "Cybathlon", an international competition was held using the same brainwave sensor necomimi employs. To my surprise, I clinched first place among the participants. It was an event that made me feel the potential for the brain's plasticity to construct a new circuit to control a supposedly non-existent "organ".

Thus, brainwaves and bio-signals seem to have potential beyond specific applications like controlling devices. They can enrich communication, offer insights into one's mental and physical state, and ultimately empower individuals to enhance their intrinsic abilities.

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Editors' Dialogue

—Which tools changed your world when you used them?

Morioka   About 25 years ago, around the dawn of the Internet, I felt the world change drastically. I was deeply moved by the fact that I could communicate with people who lived in entirely different places, were of different ages, had different jobs, yet shared the same interests.

Tsuchiya   Google Search and smartphones also changed the world. With memory being externalized, the way I organize information internally changed. As long as I have the right search keywords, I can recall things instantly. It certainly feels like my approach to thinking has changed.

Izumida   Ever since I started relying on Google Photos, I feel like my memory has been augmented. I can search for pictures using vague descriptions like "photos taken in Ishikawa Prefecture" or "photos shot in 2015" and recall memories from them.

Ikeda   I was also amazed when tools like Google Docs, which allow for real-time collaborative editing, emerged. We can draft meeting notes while discussing. I think the concept of simultaneous editing contributes to making roles more fluid and equal.

Shimizu   For me, it's AirTag. After AirTag was introduced, the time I spent searching for things throughout the day drastically decreased. With AirTag, it feels like various belongings are connected to me by threads.

Nakano   As I mentioned in the column, it's necomimi for me. I used to not know how to relax when I was tense, but after trying various methods with necomimi on, I discovered that I could achieve a relaxed state with aromas and breathing. Since then, whenever I feel tense, I make sure to take long breaths.

—Have you felt a generation or cultural gap in the way communication tools (like phones or social networking services (SNS)) are used?

Tsuchiya   When I first heard words like "Aka-baré (one's (secret) account on SNS is discovered by people whom he/she knows in real life)" and "Sub-Aka (second account)", it was quite shocking. It's not just about anonymity, but also how personas are distinctly crafted and managed across multiple accounts. While I can understand wanting to differentiate one's real self from a hobby-centric social graph, managing all of that seems daunting.

Ikeda   For a while, there was this phenomenon called "Ojisan LINE", pointing out the unique texting style typical of older men (ojisan) on LINE, a popular messaging app in Japan. It's interesting how even with the same tool, distinct groups can show different tendencies.

Morioka   In a particular project, while the venue was always filled with young people, there were very few SNS posts. They apparently don't use open SNS much and instead exchange information on platforms like LINE or private accounts.

Izumida   Honestly, I don't understand the concept of "friends on SNS" at all. How do you meet someone on SNS, get close, and eventually call them a friend? It's still hard to associate myself with this way of forming social connections. This might not just be about SNS but more about my own social understanding.

Shimizu   During the COVID-19 pandemic, while working in both the US and Japan, I noticed that many in Japan believe that "important things cannot be conveyed online". They seemed eager to revert to face-to-face conversations post-pandemic. Meanwhile, people in the US had a stronger inclination even before the pandemic to handle everything over the phone or online. As a result, the pandemic-induced work style changes have become irreversible in the US. In that sense, I feel that the impact of the pandemic was more profound in the US.

—To what extent are you comfortable with augmenting your abilities through technology?

Morioka I have a resistance to modifying my body. It's not so much about the technology, but more from the same perspective as getting piercings or tattoos. I have good eyesight, but even if I didn't, I think I'd hesitate before undergoing LASIK eye surgery or getting intraocular contact lenses.

Tsuchiya I don't have much resistance to wearable devices because they can be removed at any time. Recently, I've started using the Oura Ring, a ring-type device that tracks heart rate and activity. On the other hand, so-called invasive devices that are embedded into the body are something I'd resist, even if their safety is guaranteed. Personally, I expect that after a few years of mainstream adoption, based on data from early adopters of invasive devices, we might achieve similar functionality with non-invasive ones.

Ikeda From the viewpoint of invasive vs. non-invasive, I too have a strong resistance to the invasive kind. I can't even stand watching injections in health check-ups or surgery in dramas. The idea of having foreign objects, like microchips, embedded in my body is quite disturbing. However, I'm always eager to try non-invasive technologies.

Izumida When I think about what my decision criteria would be, I think I make decisions on two axes: in terms of whether they are reversible or irreversible, and whether the effects they produce are critical or not. I believe my current decision criteria matrix would look something like this.

Not Critical

Adopt	Not Adopt

Reversible ← → Irreversible

Adopt	Adopt
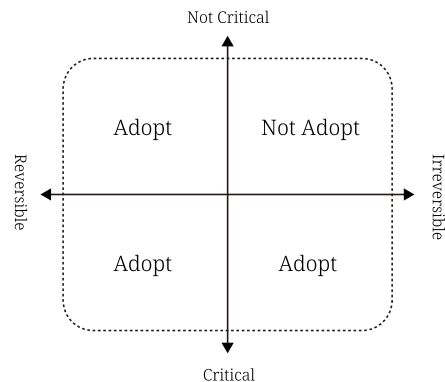
Critical

Izumida When I see people adopting irreversible things with critical effects, I sometimes feel like "it's a little bit crazy". An example would be in the field of Body Modification, when someone implants an RFID chip in one's arm, or similar things like that.

Shimizu I feel very close to Mr. Izumida's standards of value. When I first started living in the US, the frustration of not being able to use English well was so great that I half-seriously looked for ways to enhance my English ability by undergoing brain surgery or some kind of enhancement. It was critical to me at that time.

Nakano Fortunately, I am currently in good health, so the ideal technology for me would augment my capabilities in a way that continues even after the equipment is removed, like rehabilitation or EdTech. However, as with Mr. Shimizu's story about what is critical, it seems that what one needs and the standard for how invasive something can be changes depending on one's situation.

Izumida Vaccinations, which involve introducing foreign substances into the body to alter immune cells, could be considered a form of body modification. While it's not possible to generalize, I felt many engineers were too quick to receive the new COVID-19 vaccine. Considering it's a new type of vaccine, mRNA vaccine, and it was developed rapidly to halt the spread of the virus, I personally think we could have been a bit more cautious. But seeing people rush to get vaccinated, saying "It's the mRNA vaccine! It's amazing!" and posting about side effects on social media in high spirits, it seems like there's a layer of society that wants to experiment with new scientific advances on their bodies, driven more by desire than by acceptance.

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