



Solutions to Social Issues Enabled by Advanced Visualization Technologies

Using printing technology to communicate the right information accurately

High-definition Visual Media Are Changing the Way We Communicate

Communication using words and printed text involves conveying images and emotions by converting them into text information. However, it is a means of communication that can easily lead to an incomplete understanding. The person conveying information may not be able to fully express what they are thinking or feeling using words and the person receiving the information may not properly understand what is being communicated.

In the case of visual expression, however, it is said that a photograph can convey information equivalent to 2,000 characters of text and that watching video is equivalent to several million characters of text information. With high-quality 4K and 8K video in particular, the amount of information contained within is even larger because the images have higher definition and resolution. This means that the level of immersion of the experiences is heightened because what is displayed looks very similar to the real scenery.

The use of these kinds of visual media is significantly changing the way in which we communicate. If the deployment of 5G mobile communication systems enables not just high-speed, large-volume transmission, but also multiple connections and minimal delays, it can drive the use of high-quality visual media and make it possible to deliver a wealth of content to large numbers of people.

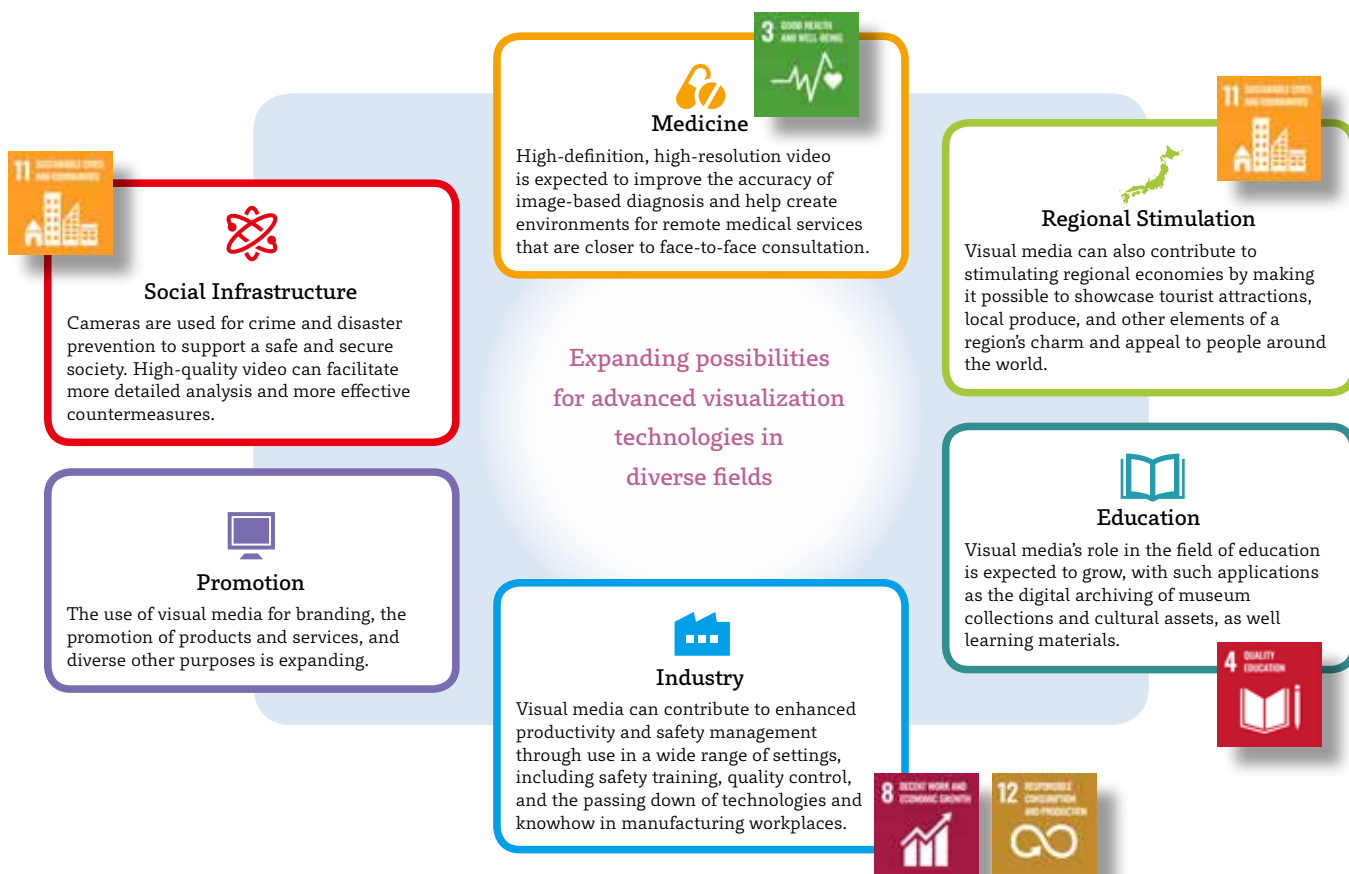
Toppan's DNA and Technology Can Contribute to a New Foundation for Society

Toppan has engaged in the business of printing since its foundation and has developed printing technologies over many years that accurately record and communicate information. This expertise is leveraged in the production of media employing advanced visualization technologies, such as high-quality video and virtual reality (VR).

Printing technologies for reproducing shape and color in detail facilitate the production of VR content with an overwhelming sense of immersion and realism. Toppan takes advantage of the experience and track record built up in the daily handling of high-resolution, high-volume data to create high-quality 4K and 8K visual media.

By providing high-definition visual expression technologies, Toppan not only meets promotion, marketing, and other needs of businesses and local governments, but also contributes to solutions to social issues through the use of such technologies in fields including education, manufacturing, disaster and crime prevention, medicine, and art.

Toppan will continue to leverage its DNA and outstanding technologies to respond to an ever-evolving society while proactively creating and rolling out services that can help form a new foundation for that society.





Possibilities of advanced visualization technologies ①

Opening the Mind with Virtual Windows

Natural Window—a space solution offering hyper-immersion

The Natural Window System and its Effect

This solution involves taking high-quality 4K video content shot by Toppan using special techniques and displaying it on digital signage with a window frame to create an experience of window scenery with an outstanding sense of immersion.

Analysis based on measurement of biological response to break rooms featuring Natural Window, posters, or blank walls has shown that Natural Window helps relieve stress and enables people to refresh in a short time period. By introducing Natural Window as a means to improve workplace environments, Toppan aims to contribute to work style reform and health management for employees and staff.



Break room at Toppan's BPO Square Asaka facility

Topic

Pilot Project to Support the Akita City Government's Efforts for an Age-friendly City

To contribute to efforts by the government of Akita City in Akita Prefecture to create an age-friendly city,¹ Toppan worked with four television and communication-related companies in a pilot project for "Natural Window for CATV,"² a new video distribution service. The test involved getting feedback from users and transmitting video to household 4K televisions to spur communication and participation in society by senior citizens. By encouraging social engagement by seniors, Toppan hopes to help maintain social infrastructure and address issues faced by an ageing society, such as labor shortages.

1. The World Health Organization (WHO) launched a project in 2007 to address the issues of global ageing, urbanization, and the ageing of urban populations. In December 2011 the government of Akita City became the first local authority in Japan to join the WHO Global Network for Age-Friendly Cities and Communities. Subsequently, in March 2019, Akita was selected from cities in the network as one of 11 undertaking advanced initiatives.
2. Pilot project for high-quality 4K video transmission conducted in Akita City to support the creation of an age-friendly city.
Related press release (in Japanese)
<https://www.toppan.co.jp/news/2020/03/newsrelease200312.html>

Possibilities of advanced visualization technologies ②

Preparing for Evacuation

Evacuation simulation system

Visual Content Enables Repeated Experience

In May 2019, Toppan worked with the government of Akita City, Akita Prefecture, to develop an evacuation simulation system that uses visual media to demonstrate which locations might become flooded and how they become flooded in the event of a tsunami caused by a large-scale earthquake. The system enables people to experience the specific action and routes to take when evacuating in such an emergency. Visual content simulating a tsunami was also produced. It is hoped that repeated use of the system and content will allow all residents to be better prepared for evacuation based on the simulated experience of the dangers of tsunamis and what action needs to be taken to stay safe.

Features of the Evacuation Simulation System

The system facilitates repeated simulated experience of evacuation based on the concept of "faster, higher, further" advocated by the Akita City government.

A realistic simulation of a tsunami approaching has been produced in 360-degree virtual reality. This can be shown on a large screen for multiple viewers or viewed on head-mounted displays for a highly immersive experience. Using a controller, evacuation can be commenced from any location within the virtual space, and users can experience evacuating via the appropriate routes to designated

evacuation areas. By making use of a function for going back over one's own evacuation route and switching between aerial, rear, and other views, users can confirm the action they need to take from multiple perspectives.

Features of the Tsunami Simulation

This content aims to help people confirm visually the dangers of a tsunami hitting the city and explains clearly the precautions that need to be taken when evacuating.

Actual video of the Tsuchizaki district in Akita City has been combined with computer graphics to produce something that is easy for residents to understand. The content is available for viewing on the Akita City website.



A scene from the evacuation simulation system. Users can confirm such details as time from start of evacuation, sea level, and rearview mirror display as they use the system.



The tsunami simulation content explains what would happen if a tsunami hit the city using real images to enable residents to be prepared for evacuation.





Possibilities of advanced visualization technologies ③

Transcending Space and Time to Share Abilities

IoA Virtual Teleportation®



Overcoming Distance and Time to Share Abilities

Toppan is undertaking joint creation and development with Jun Rekimoto, professor of the Interfaculty Initiative in Information Studies at the University of Tokyo, who advocates the Internet of Abilities (IoA). One of the outputs of these activities is the launch of IoA Virtual Teleportation® and efforts to drive its application in society. The IoA is a concept for the infrastructure of future society and involves fusing people and technologies via networks to expand consciousness and abilities.

Aiming to expand human capabilities, this initiative is expected to be effective for a wide range of applications. These include physical rehabilitation, support for elderly people and those with limited mobility, and the tracking of movements of experienced practitioners to enable training and the passing on of specialist skills.

Topic

Virtual Hometown Excursion Enabled by IoA Gakuen™

IoA Gakuen™ (“gakuen” means “school” in Japanese) employs IoA Virtual Teleportation® technology and uses 4K video and 5G-related communication to connect schools with distant locations and provide a platform for broad-based learning for children that overcomes the physical and time constraints of travel.



In November 2019, IoA Gakuen™ was used for a virtual hometown excursion by children attending the Futaba Minami and Kita elementary schools in Iwaki City, Fukushima Prefecture. The majority of the town of Futaba has been classified as an area to which people cannot return following the 2011 Tohoku earthquake and tsunami. The virtual excursion provided an opportunity for children to learn about the state of the town today and the efforts being undertaken for restoration and reconstruction.

Possibilities of advanced visualization technologies ④

Supporting Accurate Diagnosis for Remote Medicine

Color management system and high-definition video technologies

Enhancing Dialogue and Information Sharing Between Doctors

To address the issue of support for medical care in regions with limited numbers of specialist physicians, growing attention is being focused on remote medicine, in which specialists are connected with local doctors and can communicate with them via networks. Due to the spread of COVID-19, remote medicine has increased in importance and is being used not just in regional areas but also by doctors in urban locations.

In addition to conveying information via language and numerical data, video is indispensable for facilitating remote examination and consultation. Accurate communication of visual information requires both high definition and sophisticated reproduction of color information.

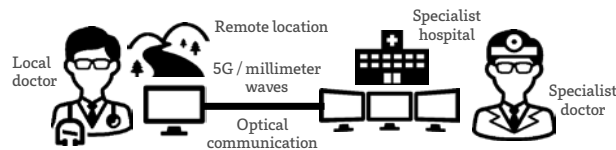
Toppan has expertise accumulated over more than 30 years in handling high-definition digital data for printing, which is combined with advanced control technologies and reliability that can withstand long-term use. Toppan aims to contribute to enhancing the quality of remote medical care and enabling healthy lives by facilitating the exchange of accurate visual information.

Concept display in the Toppan booth at CEATEC 2019 Society 5.0 Town



Related press release (in Japanese)
https://www.toppan.co.jp/news/2019/10/copy_of_newsrelease191011_1.html

Concept for Application



Toppan aims to combine high-definition video technology with a color management system for reproducing color data with a high degree of accuracy to enhance the quality of communication between doctors through 5G networks and other means for high-speed, large-volume transmission.

Causes of disparities in communication and assessment when there is a significant difference between input and output

<p>Imaging device</p> <p>Different imaging methods and subjective automated image processing</p> <p>Extraneous correction</p>	<p>Display device</p> <p>Differences in display characteristics of each device</p> <p>Not adjusted</p>	<p>Light source</p> <p>Different color components depending on light source</p> <p>Not appropriate</p>	<p>High definition (information volume)</p> <p>Ultra-high-definition digital data for printing</p> <p>Not clear</p> <p>Resolution / bit rate</p>
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Comprehensive control ≙ color management system



The Ongoing Pursuit of Accuracy in the Digital Field

Takashi Suzuki

Senior General Manager
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Evolution from Visualization to Accurate Communication

The work of a printing company can be said to be the processing of information for visualization. The core of printing technologies is to put what the customer is envisaging into a visual format and give it its finished form using photographs, text, design, and a range of other technologies. Digital evolution of the expression technologies we have built up over the years is a major theme for us now. Our basic approach is to develop new services centered on advanced visualization technologies and apply them effectively to help shape Society 5.0, which will be sustainable and smart. The key to this will be going beyond visualization to achieve accurate communication of information. For example, in the creation of digital archives of cultural heritage, we work to faithfully reproduce lost portions based on research of large numbers of documents so that such heritage can be passed down to future generations. The social application of these initiatives involves creating and providing mechanisms for systematically enabling the accurate communication of information, and I believe that this will lead to social innovation.

Core Technology of Accurate Color Reproduction

Toppan has worked for many years on developing the real-time rendering engines that are vital to our virtual reality (VR) business so that they reproduce colors and textures accurately. There are other engines available that can produce extraordinary images and beautiful color expression, but we felt that we needed to develop our own engines because it is very difficult to reproduce textures that change depending on the material, such as the soft look of fabric or complex depth of reflection seen on paint on a car.



The International Space Station reproduced by a rendering engine as part of VR content for the Fukuoka City Science Museum.

With digital communication via networks, there are issues such as deterioration due to the compression of large volumes of data and different colors being displayed by different devices. This means that color management technology that conveys the right color under various conditions will surely become more and more important. For example, as part of measures in response to the COVID-19 pandemic, the number of hospitals offering online services starting from the initial consultation has increased. When doctors interact with patients via screens, if the color of the person's face is not displayed accurately or color is automatically adjusted by the camera or image processing engine, it becomes difficult to provide an accurate diagnosis. We need to be uncompromising in our pursuit of precision to ensure that medical examinations online can be performed with the same level of accuracy as those conducted face to face.

The Potential Offered by Second-generation Digital Signage

Conventional digital signage has been a substitute for signboards, with the same advertising sometimes being shown on multiple displays. If we think of this as the first generation, second-generation digital signage could be said to be space design that prompts human action. We are conducting research based on exploring the idea that if we manage information that appeals not just to sight but to all five senses in spaces with displays, it might be possible to influence people's emotions. In June this year we launched a space design solution called Your Space™. We believe that this solution can contribute to working style reforms at companies by centrally managing and controlling video, sound, aroma, and lighting to enhance people's concentration. Toppan opened NIPPON GALLERY TABIDO MARUNOUCHI in Tokyo to contribute to efforts to make Japan into a tourism-oriented nation and revitalize its regions. The facility features simulated natural lighting in the ceiling and Natural Window displays in the walls. The space has been designed in various ways to showcase the charms of Japan. This includes a reconstruction of the garden of a traditional Japanese tea house and a high-intensity, high-definition LED wall that enables life-size displays of scenery. The gallery and its design have been a hit with visitors.

Better Living Enabled by Digital Technologies

We have also launched "beyond 5G" initiatives that look to the future. We are conducting a range of pilot projects for the application of 5G technologies in society, but a limit is being seen even in the potential of 5G when it comes to expanding stimuli that appeal to the five senses. We are therefore conducting research into Multi-access Edge Computing (MEC), which processes data at a network location closer to final users.

In the post-COVID-19-pandemic world, there will be heightened demand for contactless, remote communication. Toppan will be researching and developing an array of services based on IoA Virtual Teleportation®, which transcends space and time to enable an experience in which users feel as if they are at the location itself. In transcending space and time, we are also engaging in efforts to record and explore human behavior. For example, in the field of archaeological surveys, we are contributing to research activities with new digital techniques, providing technologies for accurate 3D visualization of historical sites and ruins above and below ground. We also continue to collaborate with universities and research institutions in Japan and overseas to research Maya civilization ruins in Honduras and Guatemala and the Ayutthaya and Sukhothai historical sites in Thailand.

From here on, we will see a variety of business activities being conducted in cyberspace. I take pride in the fact that with our history of using printing to consistently disseminate real-world information, we are perfectly positioned to contribute to shaping a smart society in which cyberspace and the physical world are seamlessly linked. We will continue to take on new challenges targeting a world in which people use digital technologies instinctively and intuitively as part of a better way of living.