Cybernetic Avatar

CA Economic White Paper 2025

Cybernetic Avatars Shaping Value in the Virtual–Physical Convergence

Research group on Information Society Innovation for the Next Generation

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CA Economic White Paper 2025

First Printing: January 1st, 2026, First edition (Version 1.0)

Editor and Publisher:
Research group on Information Society Innovation for the Next Generation
2F, Harks Roppongi Building, 6-15-21 Roppongi, Minato-ku, Tokyo 106-0032
(Inside the Center for Global Communications, International University of Japan)
Website: https://www.glocom.ac.jp

Introduction

This white paper provides a comprehensive overview of the current state and future prospects of cybernetic avatars (CAs) generated through computer technology. It focuses on gathering evidence from economic, industrial, and social perspectives. CAs are technologies that reproduce human forms and movements within virtual spaces and have already been adopted across a wide range of applications, including virtual reality (VR) games, metaverse platforms, and online conferences. These avatars range from highly realistic human representations to more stylized or fantasy-inspired designs that enhance users' sense of immersion and improve communication quality in virtual environments.

In recent years, the application of CAs has expanded beyond online education and entertainment to more practical and advanced fields, such as telemedicine and customer service. For instance, a major telecommunications provider has been conducting a proof-of-concept trial of a telemedicine system that allows doctors to monitor patients' facial expressions and gestures through CAs, suggesting that effective communication can be achieved without the need for physical presence. The growing prevalence of remote work has led to emerging use cases in which head-mounted displays (HMDs) integrate with CAs for virtual meetings. These innovations generate new value, for example, by enabling virtual tour guides in the tourism and entertainment sectors or by supporting remote sales of local specialty products.

Because CAs consolidate a wide range of data, including user behavior, speech, and facial expressions, they have attracted attention for their potential to yield deeper insights than traditional marketing techniques. Some companies are already implementing CAs as customer interfaces, analyzing real-time purchasing behaviors and reactions to personalize products and services. At the same time, however, a number of unresolved challenges remain. These include the management of personal and behavioral data collected in virtual spaces, avatar-related harassment, and inequalities stemming from the digital divide.

This white paper seeks to organize these complex and multilayered issues and examine the evolving applications and challenges of CAs. Its broader objective is to present an evidence-based outlook on the potential risks of CA utilization in economic, industrial, and societal contexts. Assessing the extent to which CAs can contribute to solving Japan's social challenges, improving quality of life, and fostering economic development is essential. This includes discussions of the relevant technologies, legal systems, and ethical considerations. We hope that the insights and analyses presented here will serve not only policymakers, businesses, and research institutions but also individual users in making informed decisions about CA use, ultimately contributing to the creation of a more prosperous and sustainable information society.

December 2025

Research group on Information Society Innovation for the Next Generation

Index

Chapter 3 Social transformation brought about by CAs (international comparison) 41

1

Trends and the domestic market size of CA services

1.1. Trends in B2C CA services

The business-to-consumer (B2C) market[1] for cybernetic avatars (CAs) can be broadly classified into three categories: (1) services in which users themselves use CAs, (2) services in which CAs provide customer service or similar functions, and (3) CA-related consumption. This section outlines the characteristics and specific examples of each category and illustrates the current state and potential of CAs.

First, "services in which users use CAs" (Figure 1.1) are characterized by the user's activities in virtual spaces through their own CA. In the entertainment domain, a typical example is the use of CAs in games, such as Fortnite or VARP. With the advancement of virtual reality (VR) technology and user-generated content, spaces in which players can create characters and worlds and enjoy immersive experiences have expanded. In the field of education and training, platforms such as FAMcampus and Labster, which enable classes and experiments to be conducted via CAs in virtual spaces, are beginning to gain traction. They are attracting attention for their potential applications in supporting non-attending students and in reskilling. In the communication domain, metaverse platforms such as VRChat and The Sandbox, which allow users to connect globally through CAs, are gaining popularity, offering the appeal of participating in various events and community activities online. For business and office use, systems such as Meta Horizon Workrooms and Microsoft Mesh have emerged, enabling virtual meetings and training, with increasing numbers of remote members holding meetings and collaborating via CAs. In healthcare, initiatives such as VR rehabilitation (e.g., mediVR Kagura) aim to enhance motivation and rehabilitation effectiveness by allowing users to move their CA bodies. In tourism and real estate, the number of virtual housing exhibitions and virtual tourism experiences is increasing, allowing users to gather information and enjoy simulated experiences without visiting a location in person. Thus, services in which users use CAs are notable for directly enhancing their sense of immersion and experiential value, with high applicability across diverse industrial sectors.

Second, "services in which CAs provide customer service" (Figure 1.2) refer to cases where users receive explanations, guidance, or communication services from a CA. Examples include Dai Nippon Printing's "DNP Virtual Customer Service," where remote staff provide customer service in stores or event venues through CAs, and artificial intelligence (AI)-driven CAs such as "Linka" and "Customer Service On Demand," which offer automated responses. This enables the efficient use of human resources while providing 24-hour service, multilingual support, and value-added customer engagement through CA-specific presentation effects. In the tourism industry, travel agencies have begun initiatives such as the "Travel CA Con-

1. The B2C market refers to a market in which companies provide goods or services directly to consumers. In this model, companies conduct transactions directly with consumers, and the purchase of goods or use of services is carried out by the end consumer.

cierge" for remote support, and in e-commerce, virtual shop staff provide real-time customer service. In the medical and mental health domains, systems are being developed in which AI-equipped CAs provide initial responses, such as symptom checks or preliminary counseling, and connect users to human specialists when necessary. In other words, CA-based customer service represents a group of services that can overcome the temporal and spatial constraints of human staff and contribute to labor-saving and efficiency improvements, offering potential solutions to societal challenges such as labor shortages and inbound tourism demand.

Finally, "CA-related consumption" (Figure 1.3) refers to economic spheres centered on virtual YouTubers (VTubers) and characters. Viewers (fans) typically spend money by tipping and purchasing membership subscriptions to CAs or virtual talent, buying goods, or paying to participate in live performances and events. A representative example is the tipping culture on YouTube through Super Chat and memberships, which has generated significant revenue, especially for major VTuber agencies such as hololive and Nijisanji. Related merchandise includes not only physical goods such as acrylic stands but also digital content such as voice recordings and limited wallpapers. Regarding event participation, both offline and online formats, including large-scale live performances and fan meetings, remain popular. The overall VTuber market is on a growth trajectory, with estimates placing the domestic market size at approximately JPY 80 billion in 2023. This structure, in which viewers financially support CA content, is a defining feature that has expanded new possibilities in character businesses.

In summary, classifying the CA market into three categories: (1) services in which users themselves use CAs, (2) services in which CAs provide customer service or similar functions, and (3) CA-related consumption, makes it easier to grasp the characteristics of each. These categories—CA use to enhance users' experiential value, CA deployment in corporate contexts for remote service or labor-saving purposes, and CA-related consumption in the entertainment and character businesses—are all areas in which practical applications are increasing, and further growth is expected. With the advancement of related technologies such as VR, AI, and blockchain, the CA market is likely to continue expanding, exerting multifaceted impacts on society and the economy.

Figure 1.1 List of services in which users use CAs

Service Name	Company (Country)	Overview
VARP	PARTY (Japan)	A virtual platform where users can control avatars via a smartphone app and participate in interactions and events in a virtual space using VR technology.
Fortnite	Epic Games (USA)	Users control avatars and create and publish their own games and content. Users can create 3D models and animations, and popular content can generate revenue.
NIKELAND	Nike (USA)	A virtual space created within Roblox. Users control avatars to enjoy mini-games in sports facilities or create their own games. It also features functions that reflect real-world movements.
FAMcampus	Fuji Soft (Japan)	An online education tool that allows for classes, self-study, and individual questions in a virtual space. It supports live streaming and recorded viewing of classes and is also used for supporting students who are not attending school.
VR Injection Simulator	ImaCreate (Japan)	A training tool for muscle injection for medical professionals. It includes visual learning using 3D models and practical training, providing training even in remote or difficult-to-assemble situations.
Labster	Labster (Denmark)	A virtual laboratory specializing in science experiments. It can be used on PCs and tablets, contributing to reducing disparities in learning opportunities.

Service Name	Company (Country)	Overview
LINK	ENGAGE XR Holdings (Ireland)	A metaverse platform for businesses and educational institutions. It allows the construction of unique virtual spaces for training, classes, and events.
Virtual People course	Stanford University (USA)	A large-scale online course utilizing VR. Students use Oculus Quest 2 to attend classes in a virtual space while learning about the history and use cases of VR.
VXRLabs	VictoryXR (USA)	A VR platform specializing in education. It provides learning content for vocational education, science experiments, history, mathematics, and more, supporting learning through immersive experiences.
cluster	Cluster (Japan)	Japan's largest metaverse platform. Users control avatars to participate in events and games. It allows the creation of unique worlds and avatars and hosts collaborative events with companies and municipalities.
Decentraland	Decentraland Foundation (USA)	A 3D virtual world platform on the Ethereum blockchain. Users can purchase virtual land and build games, art galleries, educational facilities, and more.
Horizon Worlds	Meta (USA)	A platform where users can interact in a virtual space and create and share their own content and events. Users create avatars and participate in games and events.
The Sandbox	Animoca Brands (Hong Kong)	A user-driven game platform on the Ethereum blockchain. Users purchase land in the virtual space and create, sell, and trade their own games, items, characters, and services.
VRChat	VRChat (USA)	A social VR platform where users interact in a virtual space through avatars. Users visit user-created virtual spaces and participate in virtual events such as exhibitions and concerts.
metatell	Urth (Japan)	A platform that provides dedicated metaverse spaces for businesses. It can be accessed via a web browser and is used for recruitment, marketing, education, and promoting international communication.
Metaverse Lifestyle Lab	Hakuhodo (Japan)	A community-based project by metaverse residents. It researches behaviors and values in the metaverse, conducts surveys and seminars, and aims to bridge the gap between companies and residents, supporting initiatives and event management.
Meta Horizon Workrooms	Meta (USA)	A service for holding meetings in a virtual space. It supports collaborative work using VR headsets and allows participation via video calls. It features customizable avatars and spatial audio technology for natural conversations.
Microsoft Mesh	Microsoft (USA)	A service that allows physically separated users to communicate in a shared 3D space. Participants use customizable avatars to engage in virtual meetings and events.
Virbela	Virbela (USA)	A platform providing 3D virtual spaces for remote work, education, and events. Users control avatars to interact in real-time in virtual offices and campuses.
mediVR Kagura	mediVR (Japan)	A medical device dedicated to rehabilitation using VR technology. It allows simultaneous training of motor and cognitive functions in a VR space, enabling safe rehabilitation.
RehaVR	silvereye (Japan)	A rehabilitation tool that combines VR technology and cycling exercise. Users aim to improve lower limb strength and endurance while virtually exploring famous locations in Japan and abroad.
Mensapo Doctor	comatsuna (Japan)	A mental support service for companies. Employees consult with industrial counselors in a metaverse space using avatars and attend seminars. Anonymity is ensured, allowing consultations with reduced psychological burden.
ANA GranWhale	ANA NEO (Japan)	A virtual travel platform that allows users to experience tourist destinations and cultures virtually on a smartphone. Users create avatars and enjoy virtual travel and shopping.

Service Name	Company (Country)	Overview
Virtual Akihabara	AKIBA Tourism Council (Japan)	A tourism and commercial support platform that recreates the streets of Akihabara in a virtual space. Local businesses and companies participate, aiming to revitalize the regional economy by connecting with creators and fans.
Virtual Okinawa	ASHIBI (Japan)	A platform that allows users to virtually experience Okinawa's tourist destinations and culture. Users can explore recreated streets and enjoy the atmosphere, traditional culture, and performing arts.
Metaverse Housing Exhibition	Kumashiro Construction (Japan)	A housing exhibition utilizing virtual space. Users freely tour houses recreated based on CAD data through avatars.
VR Model Room xR Experience Service	Nihon Unisys, Tokyu Land (Japan)	A service that allows users to experience model rooms recreated in a virtual space. It displays people and furniture, allowing users to check properties in an environment close to reality.
Meta Housing Exhibition	Living Technologies (Japan)	An online housing exhibition that publishes VR model houses created by digitally replicating existing model houses and construction properties shot in 4K high resolution.
Metaverse Housing Exhibition	Daiwa House Industry (Japan)	A virtual space exhibition where users tour and have consultations about houses. Users interact with representatives through avatars and simulate changes to flooring, wallpaper, and interiors.
REV WORLDS	Isetan Mitsukoshi (Japan)	A metaverse app for smartphones set in virtual Shinjuku. Users create avatars and enjoy shopping, events, and chatting while walking around the virtual space.
VR PARCO	PARCO, VOYAGE GROUP (Japan)	A limited-time virtual shopping service where users shop in VR. Users navigate the store as if walking through a physical space and select and purchase products online.
Virtual Market	HIKKY (Japan)	A VR event where users buy and sell avatar and 3D data products, as well as real-world products, in a metaverse venue. Users explore the venue with avatars, purchase products, visit company booths, and interact with other visitors.
BUY+	Alibaba (China)	A service that allows users to browse and purchase products in a virtual shopping mall. Users walk around the virtual space, select products such as bags and shoes, check detailed information, and make purchases.
Gucci Garden on Roblox	Gucci (Italy)	A limited-time virtual event held for two weeks. Participants explore multiple virtual spaces recreating advertising campaigns and design history, experiencing different decorations and presentations in each.

Figure 1.2 List of services in which CAs provide customer service or similar functions

Service Name	Company (Country)	Overview
DNP Virtual Customer Service	Dai Nippon Printing (Japan)	A service where sales staff remotely operate virtual characters to introduce products and provide customer service. Everything from product selection to purchase is completed online.
InterPlay Elastic Framework	Alps System Integration (Japan)	A remote customer service system equipped with avatar and multilingual support functions. Remote staff interact online, choosing and customizing avatars for communication.
KSIN	Too (Japan)	A web service that allows customer service and counter operations at stores to be conducted remotely using avatars. High-definition 3D models are adopted so staff's facial expressions can be reflected in real time.
Linka	nanoconnect (Japan)	An interactive AI service for handling inquiries, customer service, and sales activities. The AI manages basic responses, while more complex inquiries can be handed over to humans.
NARiKiRÜ	TOPPAN (Japan)	A service using 3D avatars for real-time remote customer service by operators. Used in tourist facilities and stores for guided tours and promotions.

Service Name	Company (Country)	Overview
RURA	TimeLeap (Japan)	A service for remote store customer service over the internet. The avatar reflects the staff's movements, offers remote control and translation functions for inbound support.
TimeRep	UsideU (Japan)	A cloud-based service that enables streamlined, unmanned stores through remote customer service. AI-controlled avatars are displayed on monitors, operated by offsite staff for remote customer service.
VIRTUA SKY	VIRTUA SKY (Japan)	A remote customer service using virtual characters. Through displays in commercial facilities, tourist spots, and public transport, responses and staffing can be efficiently managed from remote locations.
Customer Service On Demand	Be Motion (Japan)	An automated customer support system using large language models. AI chatbots and avatars provide 24-hour support, enabling multilingual and multipurpose use.
Travel Avatar Concierge	Kinki Nippon Tourist (Japan)	An online service for travel consultations and reservations via avatars. Users consult with expert staff from home or work, using PCs or smartphones to confirm their plans.
Vataraku cloud	BRING (Japan)	A cloud-based remote customer service using avatars. Features such as avatar calls and screen sharing offer secure and efficient communication.
Maths-Whizz	Whizz Education (UK)	An AI-powered virtual tutor. It adjusts learning plans according to student progress, allowing for individualized pacing.
Neon	Neon (Korea)	A startup funded by Samsung's research division. Develops real-time interactive virtual humans and provides digital avatars with human-like appearances and behaviors.
Replika	Luka (USA)	A chatbot app for conversations and customization with AI avatars. Individual conversation models are created based on user responses, with selectable interaction styles.
Sensely	Sensely (USA)	A virtual health assistance service using avatars. Users interact with AI for symptom evaluation and health management, including guidance to healthcare institutions and chronic disease management.
Woebot	Woebot Health (USA)	A virtual health assistance service using avatars. Based on cognitive behavioral therapy, AI conversations and games support mental health care.

Figure 1.3 CA-related consumption

Category	Overview
Tipping and Membership	On streaming platforms, users send tips to streamers to make their comments stand out. Memberships involve monthly fees for access to exclusive content and special stamps.
Merchandise Purchase	Physical goods such as acrylic stands, plush toys, clothing, as well as digital products like voice content and wallpapers are sold.
Participation in Related Events	Users enjoy live concerts, offline meetups, and online fan meetings, experiencing real-time interactions.

1.2. Domestic B2C market size of CAs

1.2.1. Overview of the questionnaire survey

This section introduces the usage status of services in the domestic B2C market for CAs and the estimated market size values. The questionnaire survey used for the estimation was conducted online in May 2025 and

asked about the actual use of services, payment status, usage history, and other factors in three types of B2C markets: services in which the respondent uses a CA, customer service and other services provided using CAs, and activities related to video distribution using CAs.

In the actual questionnaire survey, for the sake of respondent comprehension, the term "avatar" was used instead of "CA," and this is also reflected in the figures. However, in this section, the term is synonymous with CA.

The survey targeted men and women aged 20–69. In the preliminary survey, the sampling allocation was based on the number of internet users by gender and age group in five-year increments.[2] The main survey contained more detailed questions and was limited to respondents who had used CAs.[3]

Furthermore, in this chapter, to quantitatively assess the market size in the B2C domain utilizing CAs, an estimation was conducted by multiplying the usage rate by the expenditure amount, based on the above-mentioned internet survey.[4]

1.2.2. Usage rates of B2C services using CAs

The survey on the usage rate of services in which respondents used CAs found that 23.1% had used some kind of service, whereas the remaining 76.9% had never used any service (Figure 1.4). Among those who had used it, the usage rate in the gaming field was the highest at 17.7%, followed by the social field at 4.9%, the event field at 2.0%, and other fields at less than 2%.

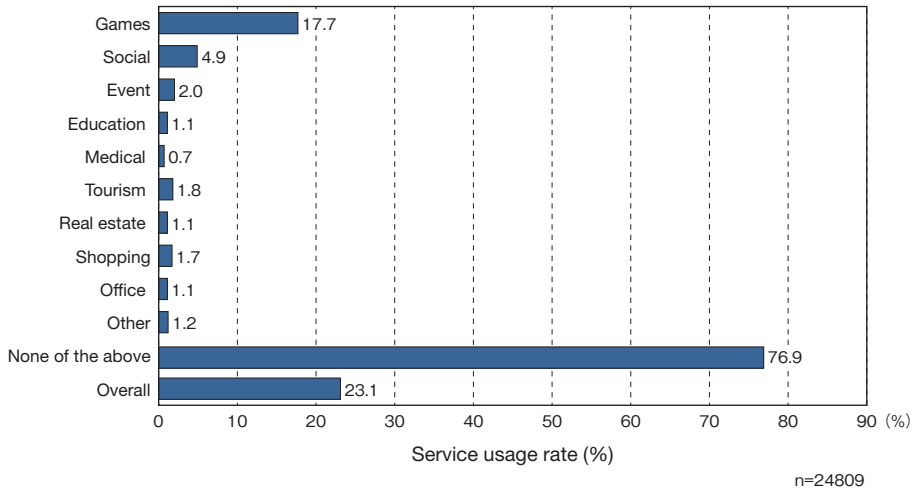


Figure 1.4 Experience with services in which users use CAs

2. Based on the Ministry of Internal Affairs and Communications' Communications Usage Trend Survey (10-year age groups) and Population Estimates (final figures as of November 2024, 5-year age groups), the number of internet users by gender and age group was estimated and allocated.
3. Weighting adjustments were made according to the incidence rates from the preliminary survey, and straight-line responses were excluded.
4. The estimated internet-using population aged 20–69 was 72,910,762. The B2C CA market was analyzed in three major categories: services in which users use CAs, customer service and other services provided using CAs, and activities related to video distribution using CAs. Each category contained 10–12 subcategories for which spending and usage status were individually recorded.

Next, the same content was tabulated by gender and age. Overall, men and younger people tended to use the services more (Figure 1.5).

Among those who had used any service, 46.2% of men aged 20–24 years had experience, and more than 30% were in the 40–44 age group. A difference is also observed between men and women, with a gap of as much as 13.9 percentage points even among those aged 20–24 years (46.2% for men and 32.3% for women). By field, young men are the majority in the gaming and social domains, which have many users, whereas in the education, medical, and office domains, usage rates among young women are relatively high. In fields related to purchasing behavior, such as events, tourism, and shopping, usage among people in their 30s and 40s is relatively high.

Figure 1.5 Experience with services in which users use CAs (by gender and age group)

Category	Gender	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69
Games	Male	41.0%	32.9%	28.3%	30.0%	26.4%	22.0%	14.4%	10.9%	8.9%	6.4%
	Female	24.6%	25.3%	21.6%	17.8%	14.2%	12.3%	9.9%	7.1%	6.9%	4.3%
Social	Male	8.7%	10.5%	9.6%	10.0%	9.4%	6.2%	4.1%	3.0%	2.3%	1.6%
	Female	4.9%	5.3%	5.7%	5.1%	3.3%	3.6%	2.2%	1.9%	1.8%	0.5%
Event	Male	4.6%	3.3%	1.9%	3.4%	3.1%	2.5%	1.8%	1.1%	1.6%	1.3%
	Female	2.8%	2.8%	2.0%	1.1%	1.8%	1.1%	1.2%	1.3%	0.9%	1.0%
Education	Male	3.5%	3.0%	1.5%	1.7%	1.4%	0.9%	0.6%	0.6%	0.5%	0.9%
	Female	1.5%	2.5%	1.1%	0.4%	0.7%	0.8%	0.9%	0.4%	0.3%	0.3%
Medical	Male	1.9%	2.6%	0.7%	0.9%	0.5%	0.7%	0.5%	0.0%	0.3%	0.4%
	Female	1.6%	2.2%	0.7%	0.4%	0.2%	0.3%	0.2%	0.2%	0.3%	0.1%
Tourism	Male	4.0%	3.4%	1.4%	2.7%	2.6%	1.5%	1.8%	1.3%	1.7%	1.6%
	Female	2.4%	2.2%	1.5%	1.4%	1.3%	1.1%	1.4%	0.8%	1.3%	0.8%
Real estate	Male	1.2%	2.2%	1.3%	1.6%	1.7%	1.2%	1.1%	1.1%	0.6%	1.0%
	Female	1.6%	1.2%	0.9%	0.9%	0.6%	0.8%	0.9%	1.0%	0.5%	0.4%
Shopping	Male	2.3%	3.1%	1.8%	2.6%	2.3%	1.9%	1.6%	1.0%	1.2%	1.2%
	Female	2.5%	2.2%	2.7%	1.0%	1.6%	1.2%	1.3%	1.6%	1.5%	1.1%
Office	Male	1.5%	2.2%	1.6%	1.6%	1.7%	1.4%	1.3%	1.3%	0.8%	0.8%
	Female	1.4%	2.3%	1.4%	1.1%	0.8%	0.9%	0.2%	0.4%	0.2%	0.0%
Other	Male	1.9%	1.7%	0.9%	0.9%	0.9%	1.4%	1.5%	1.3%	1.1%	1.8%
	Female	1.4%	0.7%	1.2%	0.9%	1.2%	0.7%	1.1%	1.3%	1.2%	0.7%
Overall	Male	46.2%	40.5%	34.1%	35.8%	31.5%	27.7%	19.2%	15.4%	15.1%	12.2%
	Female	32.3%	33.1%	27.4%	23.1%	19.3%	16.6%	14.6%	12.6%	11.9%	7.4%

n=24809

When asked about their experience of using customer service in the B2C market, 13.1% (about one in seven people) reported having received some kind of customer service (Figure 1.6).

The most common experience was "receiving customer service from a CA at an event or exhibition venue" at 4.0%, followed by "receiving customer service from a CA instead of a salesclerk when shopping in-store" at 3.5%, and "receiving customer service from a CA instead of a salesclerk when shopping online" at 3.4%. Overall, the experience of receiving customer service from CAs was less than 5%, and penetration among general consumers remains low.

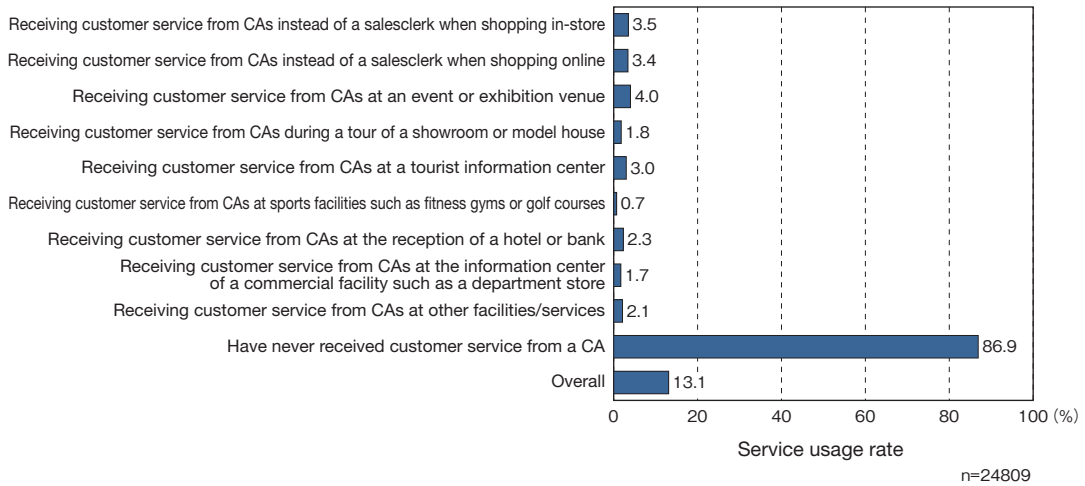


Figure 1.6 Experience of receiving customer service provided by CAs

When aggregated by gender and age group, men aged 20–24 years had the highest usage at 27.6%, followed by men aged 25–29 years (23.8%) and women aged 25–29 years (22.7%) (Figure 1.7). By field, in almost all areas, usage rates were highest among men in their twenties and women in their late twenties. Overall, approximately one in four people in their twenties had usage experience regardless of gender, whereas from their thirties onward, usage decreased sharply. In particular, usage rates among women were low; among women aged 35–39 years and older, rates were mostly below 10%.

Figure 1.7 Experience of receiving customer service provided by CAs (by gender and age group)

Scene	Gender	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69
Receiving customer service from a CA instead of a salesclerk when shopping in-store	Male	10.3%	8.4%	5.1%	4.9%	3.8%	3.1%	2.4%	1.8%	1.9%	3.0%
	Female	5.7%	7.2%	3.9%	2.0%	2.3%	1.5%	2.1%	1.8%	1.4%	1.5%
Receiving customer service from a CA instead of a salesclerk when shopping online	Male	7.5%	8.7%	4.8%	5.4%	5.4%	4.4%	2.7%	1.8%	1.9%	2.5%
	Female	4.0%	5.6%	3.8%	2.3%	2.9%	1.7%	1.6%	1.8%	1.6%	1.3%
Receiving customer service from a CA at an event or exhibition venue	Male	8.5%	7.9%	5.6%	6.5%	5.7%	5.1%	3.5%	2.8%	3.1%	3.6%
	Female	4.8%	5.3%	3.5%	2.8%	2.4%	2.2%	3.1%	2.0%	2.4%	2.3%
Receiving customer service from a CA during a tour of a showroom or model house	Male	3.5%	4.2%	2.6%	2.6%	2.7%	1.9%	1.9%	1.6%	1.3%	2.1%
	Female	2.2%	2.5%	1.8%	1.3%	0.9%	0.8%	1.0%	0.8%	1.1%	1.0%
Receiving customer service from a CA at a tourist information center	Male	6.9%	5.9%	3.9%	3.8%	3.2%	3.0%	2.9%	2.3%	2.9%	2.6%
	Female	4.2%	3.6%	2.4%	1.6%	1.8%	1.9%	2.0%	2.1%	1.6%	1.9%
Receiving customer service from a CA at sports facilities such as fitness gyms or golf courses	Male	2.2%	2.0%	0.7%	1.6%	1.2%	0.7%	0.5%	0.4%	0.3%	0.3%
	Female	1.3%	1.8%	1.1%	0.3%	0.6%	0.3%	0.1%	0.1%	0.1%	0.2%
Receiving customer service from a CA at the reception of a hotel or bank	Male	4.5%	3.8%	2.5%	2.3%	2.0%	2.2%	1.7%	2.2%	1.9%	1.8%
	Female	4.4%	4.2%	2.4%	1.1%	1.8%	2.0%	1.8%	1.6%	1.9%	1.5%
Receiving customer service from a CA at the information center of a commercial facility such as a department store	Male	3.2%	4.1%	2.6%	1.5%	2.4%	1.7%	1.3%	0.5%	0.9%	2.2%
	Female	2.8%	3.5%	2.6%	1.1%	1.4%	0.9%	1.0%	0.8%	1.4%	0.6%
Receiving customer service from a CA at other facilities/services	Male	4.5%	2.3%	2.6%	1.9%	1.7%	1.9%	2.1%	2.2%	2.1%	1.3%
	Female	2.4%	3.8%	1.6%	0.9%	0.9%	1.4%	1.9%	2.5%	2.4%	2.5%
Overall	Male	27.6%	23.8%	16.1%	15.4%	14.9%	13.2%	10.2%	10.2%	10.5%	11.3%
	Female	19.1%	22.7%	13.3%	9.2%	9.8%	7.5%	9.6%	9.1%	9.3%	9.0%

n=24809

Finally, when asked about their experience with consuming services related to video distribution using CAs, 21.3% (approximately one in five people) were found to have some kind of usage or consumption experience (Figure 1.8). The most experienced activity was "watching VTuber streams or videos (YouTube, Twitch, etc.)" at 18.8%, followed by "tipping (Super Chat, Bits, etc.)" at 3.1% and "purchasing official VTuber merchandise" at 2.7%. About one in five people watch, and among them, only approximately one-sixth proceed to purchase or tip it.

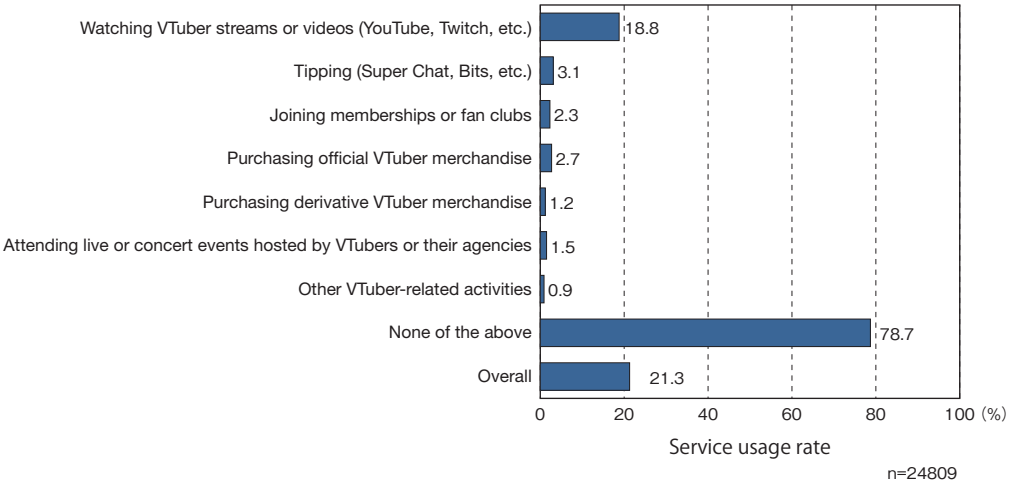


Figure 1.8 Experience with consuming services related to video distribution using CAs

When the same content was aggregated by gender and age group, overall, younger people had higher usage rates, and men's usage rates were higher than women's. In particular, the usage rate among men aged 20–24 was nearly 50% (Figure 1.9).

Figure 1.9 Experience with consuming services related to video distribution using CAs (by gender and age group)

Category	Gender	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69
Watching VTuber streams or videos (YouTube, Twitch, etc.)	Male	42.0%	33.8%	29.4%	30.9%	27.9%	22.8%	15.5%	13.1%	11.0%	9.9%
	Female	26.9%	23.2%	21.4%	18.3%	15.0%	10.8%	11.4%	8.8%	8.5%	7.5%
Tipping (Super Chat, Bits, etc.)	Male	9.7%	8.2%	5.7%	6.8%	5.0%	4.6%	1.9%	1.6%	1.0%	0.6%
	Female	5.0%	4.9%	2.7%	1.5%	1.5%	1.3%	0.9%	0.7%	0.8%	0.6%
Joining memberships or fan clubs	Male	7.7%	6.8%	4.1%	5.1%	3.3%	2.7%	1.0%	0.8%	0.6%	0.6%
	Female	4.1%	3.9%	2.9%	0.9%	1.1%	1.2%	0.7%	0.6%	0.4%	0.9%
Purchasing official VTuber merchandise	Male	10.1%	7.4%	4.2%	5.5%	3.3%	2.4%	1.2%	0.7%	0.2%	0.5%
	Female	7.3%	5.5%	3.0%	1.9%	1.8%	1.2%	0.6%	0.3%	0.3%	0.3%
Purchasing derivative VTuber merchandise	Male	3.9%	3.6%	2.7%	2.6%	2.2%	1.0%	0.5%	0.4%	0.2%	0.2%
	Female	2.6%	2.7%	1.1%	0.3%	0.9%	0.5%	0.0%	0.1%	0.1%	0.1%
Attending live or concert events hosted by VTubers or their agencies	Male	3.8%	4.4%	2.2%	3.6%	1.6%	1.4%	0.8%	0.8%	0.1%	0.5%
	Female	3.2%	3.7%	2.2%	0.9%	0.7%	1.0%	0.1%	0.1%	0.4%	0.2%
Other VTuber-related activities	Male	4.4%	2.6%	0.7%	1.3%	0.8%	1.3%	0.5%	0.4%	0.3%	1.0%
	Female	2.0%	2.1%	1.3%	0.4%	0.3%	0.1%	0.4%	0.2%	0.1%	0.0%
Overall	Male	49.2%	39.8%	33.1%	34.8%	30.4%	26.0%	16.6%	14.6%	12.1%	11.5%
	Female	31.0%	30.3%	23.5%	20.0%	16.8%	11.6%	12.1%	9.4%	9.6%	8.2%

n=24809

1.2.3. Duration of use of services utilizing CAs

In this section, the number of months of use per service category was surveyed for each service user. Overall, the duration of use for "services in which the respondent uses a CA" was longer than for "activities related to video distribution using CAs" (Figure 1.10). Among these, the "game" category had an average of 40.89 months (more than three years), and the "social" category had 29.14 months (more than two years), indicating that these categories have experienced a relatively long period of adoption among consumers.

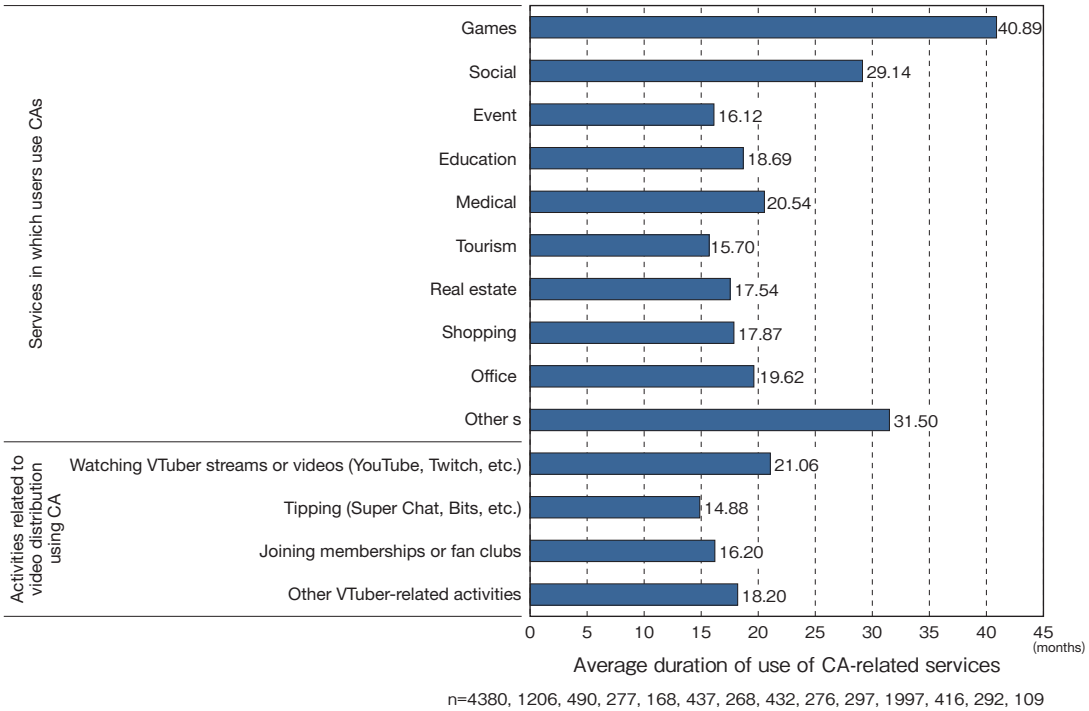
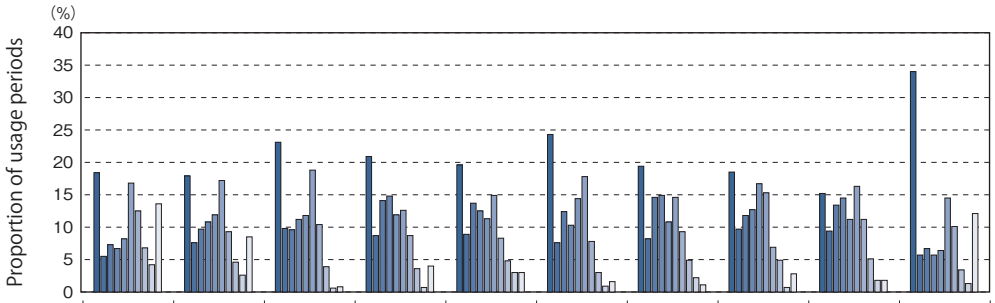


Figure 1.10 Average duration of use of CA-related services by category

Next, the proportion of selected durations of use for services in which the respondent used a CA is presented. Overall, "less than one month" accounted for around 20%, and this was consistent across all service categories (Figure 1.11). However, excluding this category, many service categories exhibited a bell-shaped distribution centered around "one year or more to less than three years." This indicates that, excluding those with an extremely short usage period, many users of services in which they used CAs have used them for approximately two years.

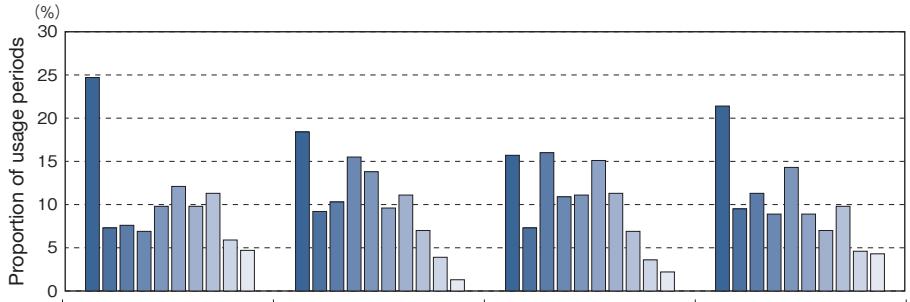


	Games	Social	Event	Education	Medical	Tourism	Real estate	Shopping	Office	Other s
Less than 1 month	18.4%	17.9%	23.1%	20.9%	19.6%	24.3%	19.4%	18.5%	15.2%	34.0%
About 1 month	5.5%	7.6%	9.8%	8.7%	8.9%	7.6%	8.2%	9.7%	9.4%	5.7%
1 month or more – less than 3 months	7.3%	9.7%	9.6%	14.1%	13.7%	12.4%	14.6%	11.8%	13.4%	6.7%
3 months or more – less than 6 months	6.7%	10.8%	11.2%	14.8%	12.5%	10.3%	14.9%	12.7%	14.5%	5.7%
6 months or more – less than 1 year	8.2%	11.9%	11.8%	11.9%	11.3%	14.4%	10.8%	16.7%	11.2%	6.4%
1 year or more – less than 3 years	16.8%	17.2%	18.8%	12.6%	14.9%	17.8%	14.6%	15.3%	16.3%	14.5%
3 years or more – less than 5 years	12.5%	9.3%	10.4%	8.7%	8.3%	7.8%	9.3%	6.9%	11.2%	10.1%
5 years or more – less than 7 years	6.8%	4.6%	3.9%	3.6%	4.8%	3.0%	4.9%	4.9%	5.1%	3.4%
7 years or more – less than 10 years	4.2%	2.6%	0.6%	0.7%	3.0%	0.9%	2.2%	0.7%	1.8%	1.3%
10 years or more	13.6%	8.5%	0.8%	4.0%	3.0%	1.6%	1.1%	2.8%	1.8%	12.1%

n=4380, 1206, 490, 277, 168, 437, 268, 432, 276, 297

Figure 1.11 Duration of use for services in which the respondent uses a CA

Finally, the survey results on the duration of activities related to video distribution using CAs are shown (Figure 1.12). In the three categories excluding memberships, "less than one month" was the most frequent response. For memberships, "less than one month" ranked second, only 0.3% behind the first, indicating a large number of new entrants. For tipping and memberships, many users reported a usage period of one year or more, suggesting that the segment engaging in additional payments beyond viewing maintains a certain duration of use.



	Watching VTuber streams or videos (YouTube, Twitch, etc.)	Tipping (Super Chat, Bits, etc.)	Joining memberships or fan clubs	Other VTuber-related activities
Less than 1 month	24.7%	18.4%	15.7%	21.4%
About 1 month	7.3%	9.2%	7.3%	9.5%
1 month or more – less than 3 months	7.6%	10.3%	16.0%	11.3%
3 months or more – less than 6 months	6.9%	15.5%	10.9%	8.9%
6 months or more – less than 1 year	9.8%	13.8%	11.1%	14.3%
1 year or more – less than 2 years	12.1%	9.6%	15.1%	8.9%
2 year or more – less than 3 years	9.8%	11.1%	11.3%	7.0%
3 year or more – less than 5 years	11.3%	7.0%	6.9%	9.8%
5 year or more – less than 7 years	5.9%	3.9%	3.6%	4.6%
7 year or more – less than 10 years	4.7%	1.3%	2.2%	4.3%

n=1997, 416, 292, 109

Figure 1.12 Duration of use for activities related to video distribution using CA

1.2.4. Estimation of market size for CA-related B2C services

In this section, the market size of CA-related B2C services is estimated.[5] The estimation results show that the annual market size of B2C services reaches approximately JPY 2.1333 trillion to JPY 2.3175 trillion (Figure 1.13). The expenditures are divided into the following two categories:

- Direct costs: costs directly associated with the use of specific CA-based services, such as monthly fees.
- Indirect costs: costs incurred to use a CA, such as equipment and environment setup expenses, or purchases of physical goods in the real world derived from the use of CA-based services.

According to this classification, the market size was estimated at JPY 1.1525 trillion for direct costs and JPY 1.1650 trillion for indirect costs.

The specific survey items were as follows:

- Ongoing costs of using CA-based services (e.g., monthly subscription fees)
- Uses within the virtual world, such as CA items (e.g., the cost of outfits worn by one's CA)
- Costs for creating a CA (e.g., expenses when outsourcing CA creation)
- Equipment and environmental setup costs (e.g., purchase of a head-mounted display (HMD))
- Amount spent purchasing physical goods through one's CA (e.g., clothing purchased in a virtual store worn in the real world)
- Amount spent on CA-based customer service (e.g., goods purchased in a physical store through interaction with CA salesclerks)
- Ongoing costs when viewing streams (e.g., watching VTuber streams or videos on YouTube or Twitch)
- One-time expenses, such as purchasing merchandise or attending live events (e.g., purchasing official VTuber merchandise)

Among these, the category with the largest share was "services in which the user uses a CA" (approximately JPY 976.5 billion), followed by "consumption of customer service and services provided using CAs" (approximately JPY 786.2 billion), and "activities related to video distribution using CAs" (approximately JPY 554.8 billion). However, for "watching VTuber streams or videos (YouTube, Twitch, etc.)," the amounts also include payments to video-sharing platforms for viewing non-VTuber content. As the survey did not

5. The method for estimating market size is as follows. First, for each category (services in which users uses CAs, customer service provided by CAs, and activities related to video distribution using CAs), the number of users U is estimated as the sum of the products of the number of internet users by gender and age group N_i and the proportion r_i of people in that group who use at least one service in the category:

   $U=\sum N_i \times r_i$

   The market size is then estimated by multiplying this by the weighted-average expenditure $\overline{q}$ for each category. For monthly costs, the estimate is $\overline{q}\times 12\times U$; for one-time costs, the estimate is $\overline{q}\times U\times(1/\overline{T})$, where $\overline{T}$ is the average number of years of use.

identify the proportion of viewing specifically related to VTubers, this represents a maximum value, including non-VTuber content, and the estimate may be overstated. If this expenditure is excluded from the market size estimate, the estimated market size for activities related to streaming is approximately JPY 370.6 billion, which should be taken into consideration.

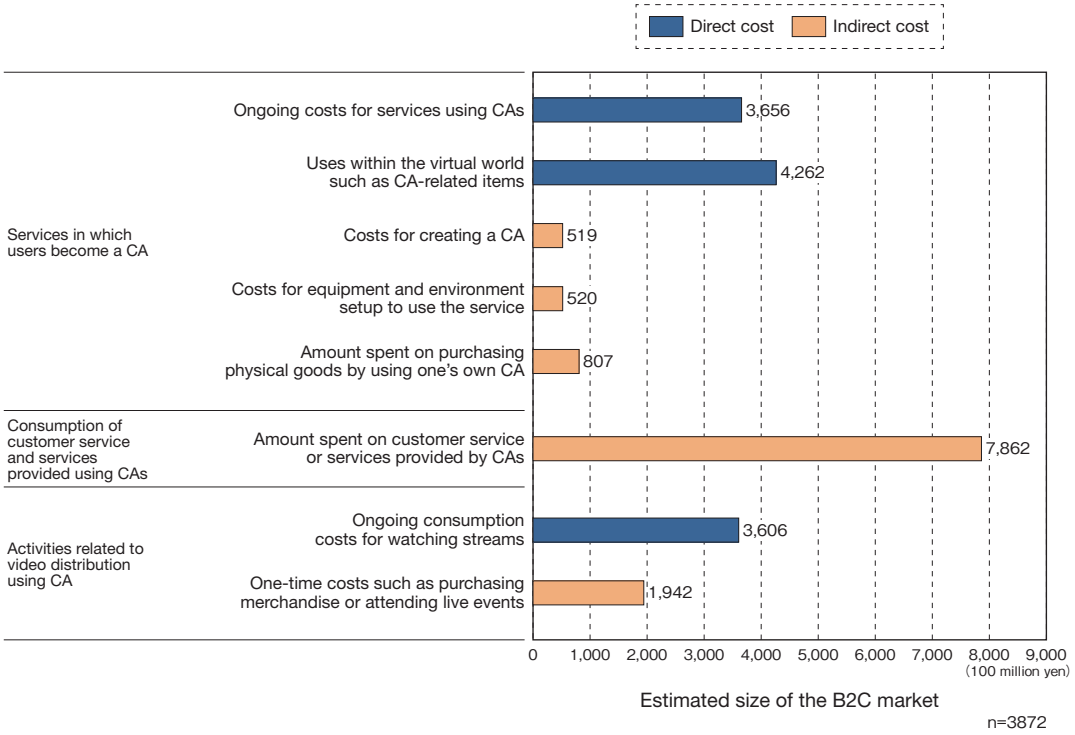
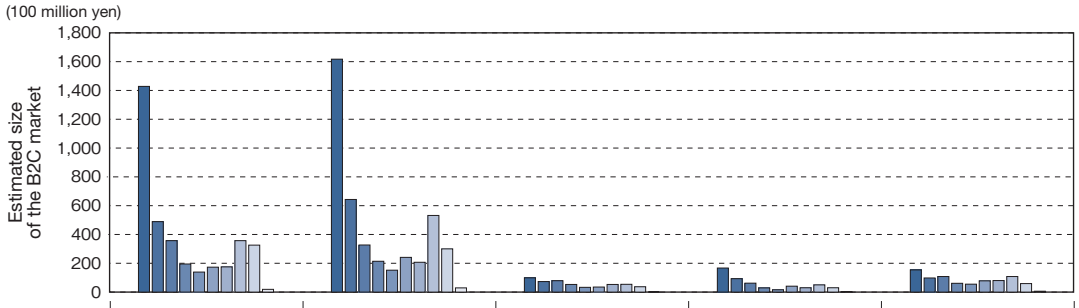


Figure 1.13 Estimated market size of CA-related B2C services by category

Figures 1.14 to 1.16 show the results for each of the three categories in Figure 1.13 broken down in more detail.

First, for services in which the user uses a CA, the market size for the "game" category is the largest, followed by the "social" and "event" categories (Figure 1.14). Expenditures are highest for services with strong entertainment and communication elements, with lower spending on those directly related to specific business sectors.



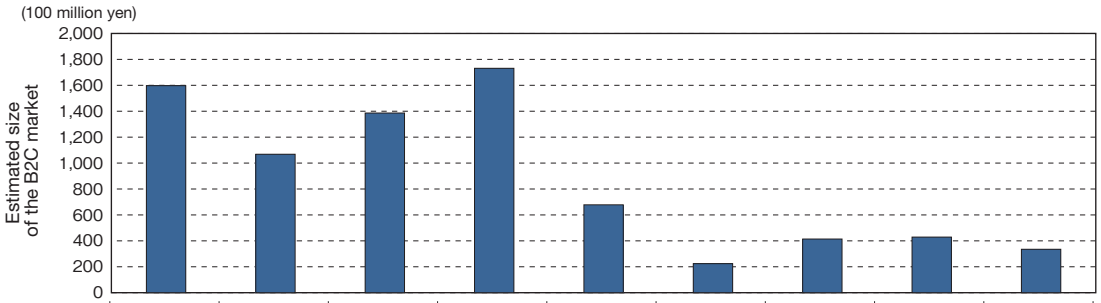
	Ongoing costs for services using CAs	Uses within the virtual world such as CA-related items	Costs for creating a CA	Costs for equipment and environment setup to use the service	Amount spent on purchasing physical goods using one's own CA
Games	¥1,428	¥1,617	¥99	¥167	¥154
Social	¥489	¥643	¥73	¥93	¥98
Event	¥357	¥327	¥79	¥62	¥108
Education	¥195	¥214	¥53	¥29	¥61
Medical	¥139	¥152	¥33	¥16	¥55
Tourism	¥173	¥241	¥35	¥41	¥78
Real estate	¥175	¥207	¥53	¥30	¥80
Shopping	¥357	¥532	¥54	¥50	¥108
Office	¥326	¥300	¥37	¥30	¥59
Other s	¥19	¥29	¥2	¥3	¥6

n=1954, 652, 297, 157, 100, 255, 178, 294, 162, 134

Figure 1.14 Estimated market size of services in which the user uses a CA

Next, in the "consumption of services utilizing CAs" category, "receiving CA-based customer service during a tour of a showroom or model house" accounted for the highest expenditures, followed by "receiving CA-based customer service instead of a salesclerk when shopping in-store" and "receiving CA-based customer service at an event or exhibition venue" (Figure 1.15).

Data from the "model house" category show that the amount spent per transaction is very high, suggesting potential for CA utilization in high-involvement products such as housing and real estate. Attention should also be paid to the growing introduction of CAs in spaces where immersion and a sense of realism are emphasized, such as event venues.

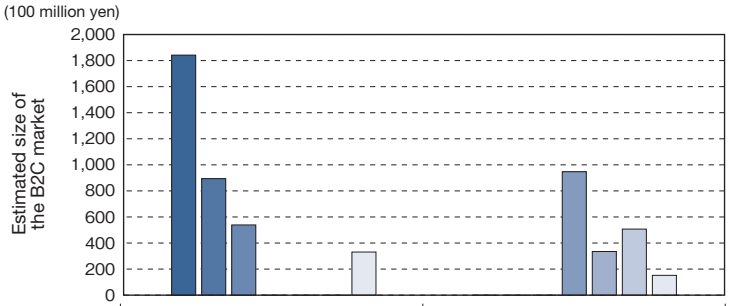


	Receiving customer service from a CA instead of a salesclerk when shopping in-store	Receiving customer service from a CA instead of a salesclerk when shopping online	Receiving customer service from a CA at an event or exhibition venue	Receiving customer service from a CA during a tour of a showroom or model house	Receiving customer service from a CA at a tourist information center	Receiving customer service from a CA at sports facilities such as fitness gyms or golf courses	Receiving customer service from a CA at the reception of a hotel or bank	Receiving customer service from a CA at the information center of a commercial facility such as a department store	Receiving customer service from a CA at other facilities/ services
Amount spent on customer service or services provided by CAs	¥1,597	¥1,068	¥1,386	¥1,731	¥678	¥224	¥414	¥429	¥335

n=540, 596, 661, 322, 480, 124, 355, 282, 345

Figure 1.15 Estimated market size of consumption of customer service and services provided using CAs

Finally, in the "video distribution using CAs" category, "watching VTuber streams or videos (YouTube, Twitch, etc.)" accounted for the largest share, followed by "purchasing official VTuber merchandise" and "tipping (Super Chat, Bits, etc.)" (Figure 1.16). This category represents an economic sphere of fan communities centered on VTubers and streamers using CAs, with the market supported by both continuous revenue from monthly subscriptions and lump-sum spending on merchandise.



	Ongoing consumption costs for watching streams	One-time costs such as purchasing merchandise or attending live events
Watching VTuber streams or videos (YouTube, Twitch, etc.)	¥1,842	¥0
Tipping (Super Chat, Bits, etc.)	¥894	¥0
Joining memberships or fan clubs	¥539	¥0
Purchasing official VTuber merchandise	¥0	¥947
Purchasing derivative VTuber merchandise	¥0	¥335
Attending live or concert events hosted by VTubers or their agencies	¥0	¥507
Other VTuber-related activities	¥331	¥152

n=1997, 416, 292, 318, 165, 205, 109

Figure 1.16 Estimated market size of activities related to video distribution using CAs

1.2.5. Impact of CA-based customer service on consumption

Next, changes in consumption resulting from customer service or services using CAs were surveyed. Overall, the proportion of respondents who answered "increased" regarding CA-based customer service exceeded the proportion who answered "decreased" (Figure 1.17). This indicates that CA-based customer service is recognized as contributing to increased consumption.

In addition, the proportion answering "no change" accounted for more than 50% in direct purchasing behaviors, such as "receiving customer service from a CA instead of a salesclerk when shopping in-store" and "receiving customer service from a CA instead of a salesclerk when shopping online." In contrast, for non-purchasing behaviors related to "receiving customer service from a CA during a showroom or model house tour," or "at sports facilities such as fitness gyms or golf courses," around 30% of respondents indicated that the CA had some effect, whether positive or negative.

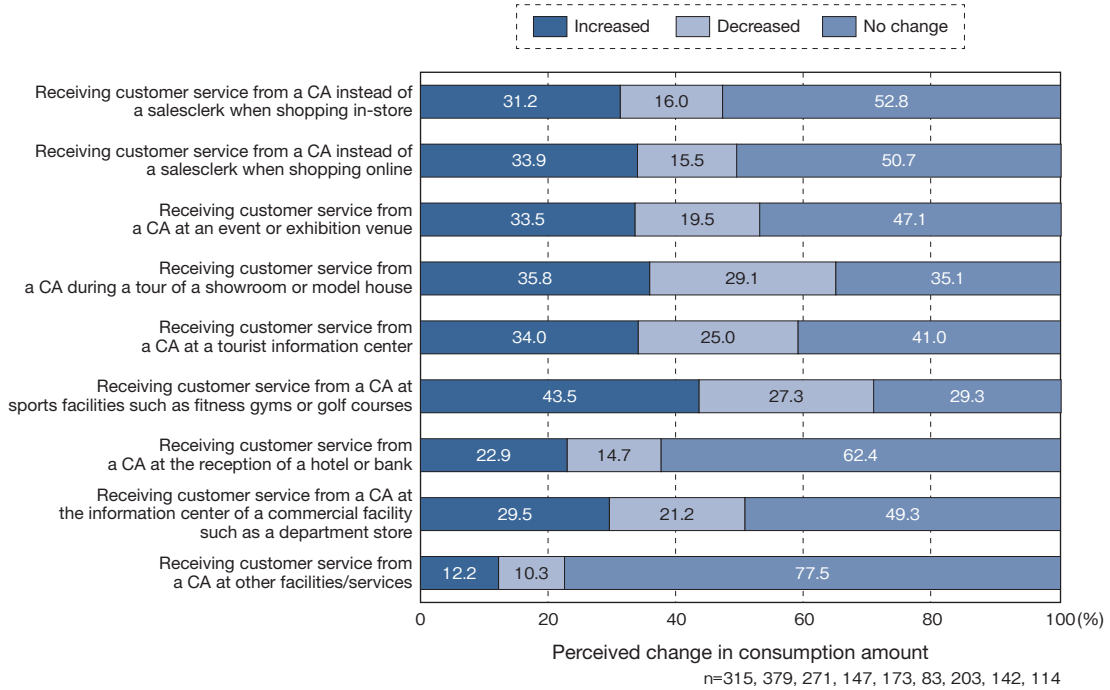


Figure 1.17 Changes in consumption related to CA-based customer service

Furthermore, respondents who indicated that they thought consumption had increased or decreased were asked to estimate the percentage by which it had increased or decreased. The average rate of change in each group was then calculated.

Among those who answered "increased," the highest was "receiving customer service from a CA during a tour of a showroom or model house" (71.6%), followed by "receiving customer service from a CA at an event or exhibition venue" (67.0%), and "receiving customer service from a CA instead of a salesclerk when shopping in-store" (54.3%) (Figure 1.18). In other fields, the increase rates were generally around 50%, highlighting the particularly strong compatibility of CAs with real estate and events.

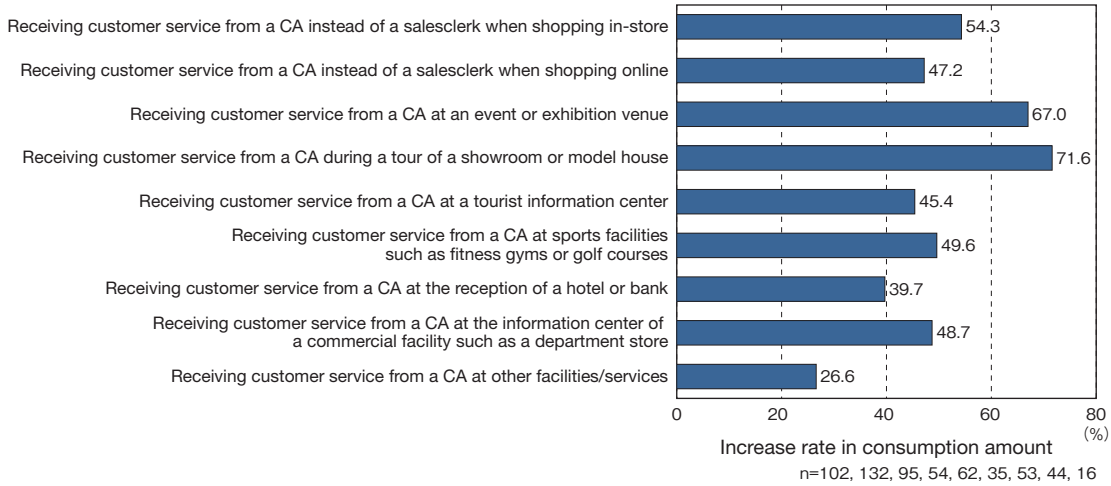


Figure 1.18 Increases in consumption related to CA-based customer service

Among those who answered "decreased," the largest decrease was for "receiving customer service from a CA at sports facilities such as fitness gyms or golf courses" (76.9%), followed by "receiving customer service from a CA at the information center of a commercial facility such as a department store" (75.1%), and "receiving customer service from a CA during a tour of a showroom or model house" (67.5%) (Figure 1.19). These results indicate that while the use of CAs can increase consumption in some cases, the magnitude of decreases when they occur can be similarly large. In particular, sports-related facilities and department stores showed substantial decreases in consumption related to CA-based customer service.

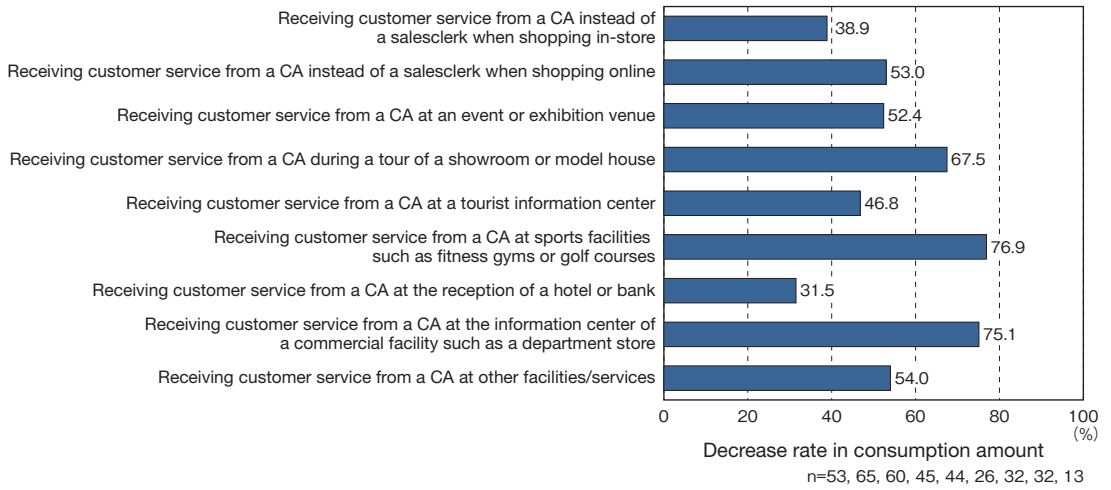


Figure 1.19 Decreases in consumption related to CA-based customer service

By combining the proportion of each response option in Figures 1.17–1.19 with the corresponding increase and decrease rates, the overall percentage change in consumption was calculated (Figure 1.20).[6] Overall, the proportion of changes showed many cases of approximately a 10% increase, indicating that CA-based customer service promotes increased consumption. Specifically, "receiving customer service from a CA at an event or exhibition venue" (12.2%) and "receiving customer service from a CA instead of a salesclerk when shopping in-store" (10.7%) were notably high, suggesting significant effects in events and shopping contexts.

Notably, CA-based customer service may have the opposite effect for some services. "Receiving customer service from a CA at the information center of a commercial facility such as a department store" (-1.5%) and "receiving customer service from a CA at other facilities or services" (-2.3%) showed decreases in consumption, indicating that CA-based customer service can sometimes reduce consumption.

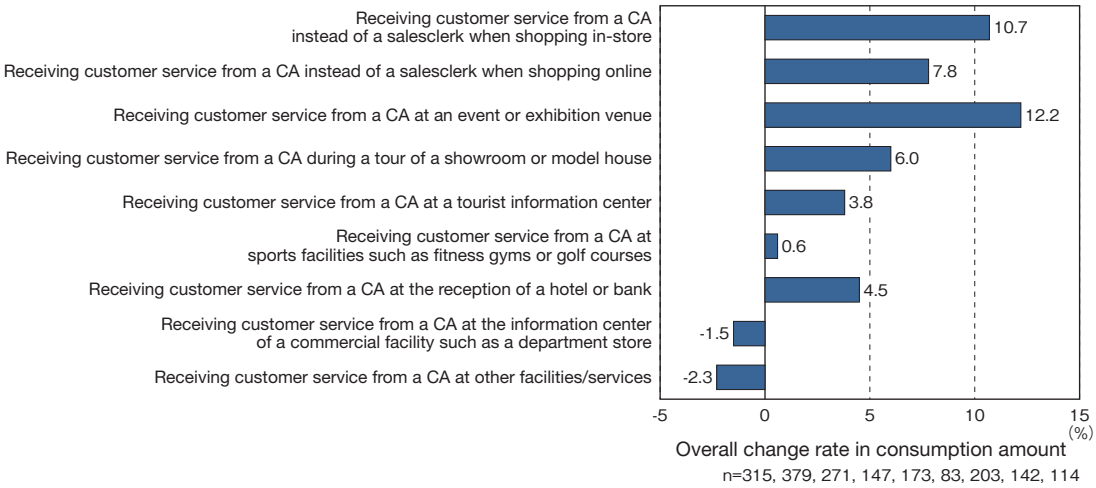


Figure 1.20 Overall increases in consumption related to CA-based customer service

6. For each type of service, the overall change was calculated by aggregating the proportion of respondents who reported that their consumption "increased" in relation to CA-based customer service multiplied by the average increase rate, plus the proportion of respondents who reported that their consumption "decreased" multiplied by the average decrease rate.

2

CA usage – an international comparison

2.1. Outline of the questionnaire survey

This chapter presents the results of a questionnaire survey conducted in four countries—Japan, South Korea, the United States, and Germany—to examine the current state of CA usage and estimate its market potential. The survey was administered online in March 2024 and collected data on actual usage of CAs and HMDs, fields of application, frequency and experience of use, intention to use, expectations and concerns about CAs, related psychological factors, internet usage habits, and the relationship between CA use and creative or hobby activities.

The survey targeted individuals aged 20–69 years registered with internet research companies in each country. Sampling was adjusted to balance users and non-users of CAs and HMDs.[7] The numbers of valid responses were as follows: Japan, 1,654; South Korea, 1,750; the United States, 1,697; and Germany, 1,638 (Figure 2.1).

Figure 2.1 Sample Size by Country

Allocation	Japan	South Korea	United States	Germany	Total
CA and HMD user	376	439	505	456	1776
CA only user	391	432	420	429	1672
Neither	887	879	772	753	3291
Total	1654	1750	1697	1638	6739

【Fields of CA Utilization】

In this survey, the following sectors were identified as potential areas for CA application, and participants were asked to respond accordingly:

- Gaming (e.g., massively multiplayer online role-playing games (MMORPGs) and social games utilizing virtual spaces)
- Education (e.g., universities, tutoring schools, and language-learning apps)
- Tourism (e.g., virtual travel experiences)

7. Approximately 25% of the sample consisted of CA users who also used HMDs, another 25% were CA users who did not use HMDs, and the remaining 50% were non-users of CAs.

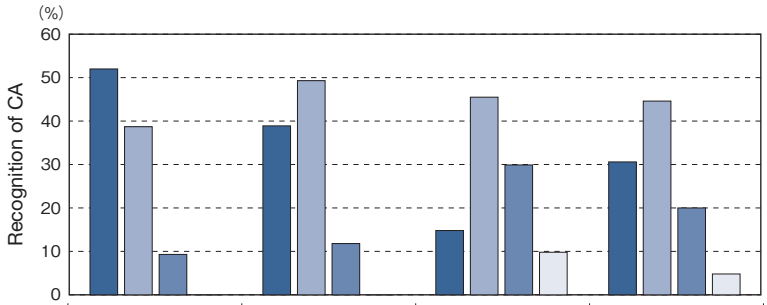
- Social interaction and communication (e.g., online exchanges using avatars)
- Chat (e.g., avatar features on messaging apps)
- E-commerce and shopping (e.g., virtual storefronts)
- Events and live performances (e.g., virtual festivals in the metaverse)
- Remote work and online meetings (e.g., virtual offices and video conferencing tools)
- Medical and healthcare (e.g., telemedicine and care support via avatars)
- Real estate (e.g., virtual model homes)
- Avatar creation (e.g., applications for generating and customizing avatars)

2.2. Recognition of CAs

The results of the CA[8] awareness survey indicated that approximately 70% of all respondents had at least some familiarity with CAs, "having heard of it" or higher (Figure 2.2). Among them, the largest proportion (44.6%) reported that they "knew what it was vaguely but couldn't explain it," followed by 30.6% who "knew it well enough to explain it to others," and 20.0% who had "only heard the name."

Among those who used both CAs and HMDs, approximately 50% reported knowing the concept well enough to explain it, whereas the figure dropped to just over 10% among non-users. This suggests that higher usage is associated with a deeper understanding of the concept.

By country, the United States had the highest level of recognition, with 49.9% reporting that they knew enough to explain it. Japan had the lowest proportion (21.3%), although the gap narrowed when responses indicating some awareness were included (Figure 2.3).

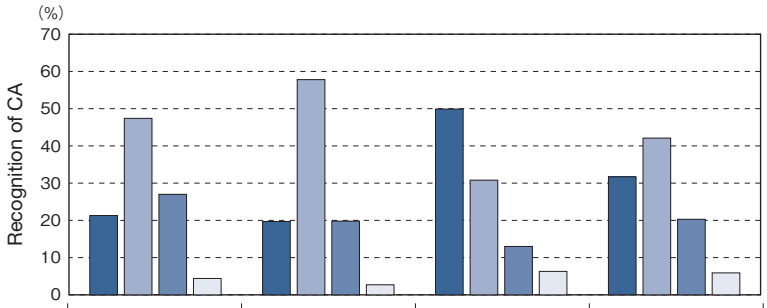


	CA and HMD user	CA only user	Neither	Overall
Knew it well enough to explain to others	52.0%	38.9%	14.8%	30.6%
Knew what it was vaguely but could not explain it	38.7%	49.3%	45.5%	44.6%
Had heard of it	9.3%	11.8%	29.9%	20.0%
Did not know	0.0%	0.0%	9.8%	4.8%

n=1776, 1672, 3291, 6739

Figure 2.2 CA awareness by CA user group and overall

8. After explaining what CA is, we are investigating how much people knew about it.



	Japan	South Korea	United States	Germany
Knew it well enough to explain to others	21.3%	19.7%	49.9%	31.7%
Knew what it was vaguelybut could not explain it	47.4%	57.8%	30.8%	42.1%
Had heard of it	27.0%	19.8%	13.0%	20.3%
Did not know	4.4%	2.7%	6.3%	5.9%

n=1654, 1750, 1697, 1638

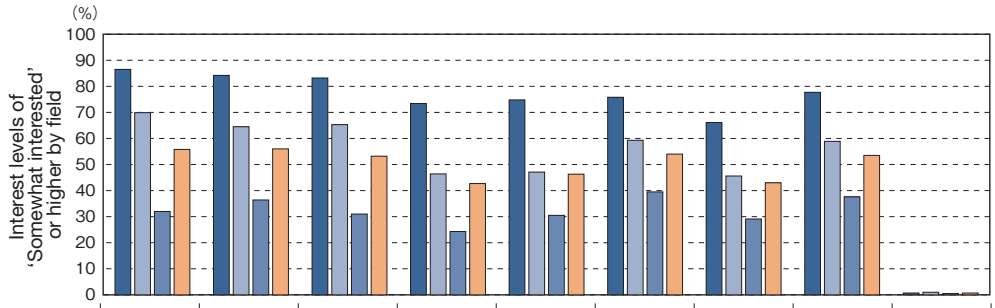
Figure 2.3 CA awareness by country

2.3. Interest in CA applications

Respondents were asked to rate their interest in various fields to which CAs could be applied on a 7-point scale. The fields with the highest proportion of respondents indicating "somewhat interested" or higher were education (56.0%), entertainment (55.8%), and tourism (54.0%), with interest levels exceeding 40% in all categories (Figure 2.4).

When broken down by CA usage group, HMD users consistently showed high interest across all fields. Non-users tended to have lower levels of interest (generally below 40%), although a notable proportion expressed interest, suggesting the presence of latent demand.

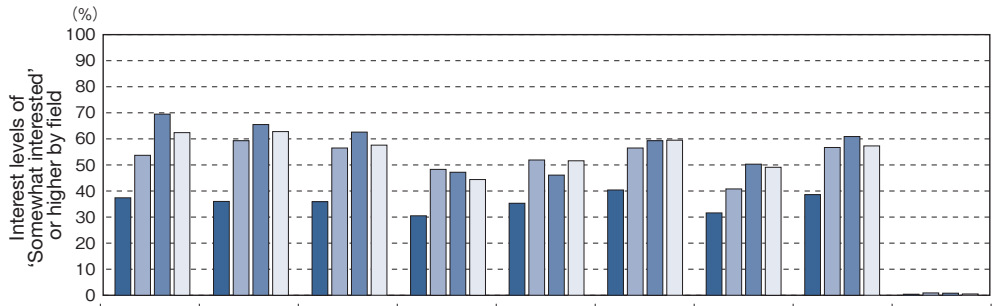
Country-level analysis revealed that interest was highest in the United States and relatively lower in Japan (Figure 2.5). In Japan, the top fields were tourism (40.4%), shopping (38.6%), and entertainment (37.4%), indicating greater interest in leisure and consumer-oriented applications.



	Entertainment	Education	Social Interaction	Business	Healthcare	Tourism	Real Estate	Shopping	Others
CA and HMD user	86.5%	84.2%	83.2%	73.4%	74.8%	75.8%	66.1%	77.7%	0.7%
CA only user	69.9%	64.5%	65.3%	46.4%	47.1%	59.3%	45.6%	58.9%	1.0%
Neither	32.0%	36.4%	31.0%	24.3%	30.5%	39.5%	29.1%	37.6%	0.5%
Overall	55.8%	56.0%	53.2%	42.7%	46.3%	54.0%	43.0%	53.5%	0.7%

n=1776, 1672, 3291, 6739

Figure 2.4 Interest in CA applications by field and user group



	Entertainment	Education	Social Interaction	Business	Healthcare	Tourism	Real Estate	Shopping	Others
Japan	37.4%	36.0%	35.9%	30.5%	35.3%	40.4%	31.6%	38.6%	0.4%
South Korea	53.7%	59.3%	56.5%	48.3%	51.9%	56.5%	40.8%	56.7%	0.9%
United States	69.5%	65.5%	62.6%	47.2%	46.1%	59.3%	50.3%	60.9%	0.8%
Germany	62.4%	62.8%	57.6%	44.4%	51.6%	59.5%	49.1%	57.3%	0.5%

n=1654, 1750, 1697, 1638

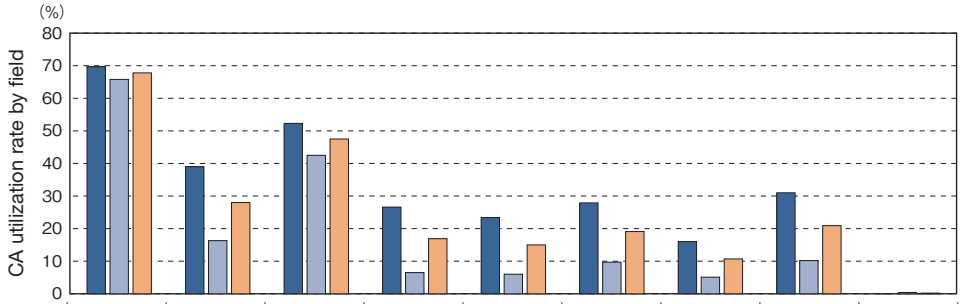
Figure 2.5 Interest in CA applications by country

2.4. Fields of application of CAs

When CA users were asked in which fields they used CAs, the highest usage rate was in entertainment (67.8%), followed by social interaction (47.5%) and education (28.0%) (Figure 2.6). These results indicate that CAs are primarily used in entertainment and social interaction contexts, whereas their application in supporting real-life activities is still in the early stages of diffusion.

By country (Figure 2.7), entertainment ranked first and social interaction ranked second across all four countries. However, from the third rank onward, country-specific characteristics emerged: education ranked third in South Korea and Germany, tourism ranked third in Japan, and shopping ranked third in the United

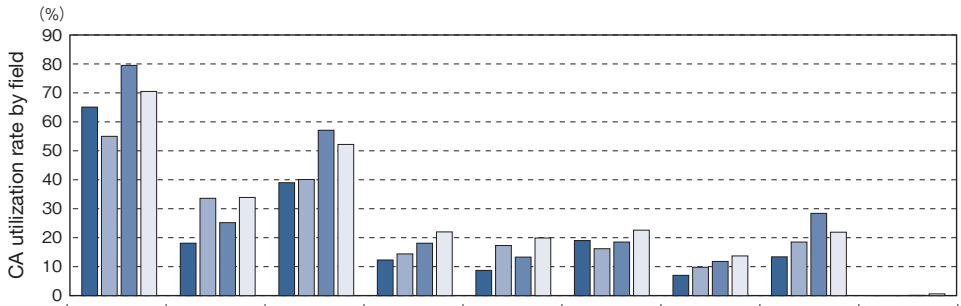
States. Although the demand for entertainment and social interaction is high across countries, the adoption of CAs in real-life support fields, such as education, tourism, and shopping, is expected to gradually expand, with national differences in the pace of diffusion.



	Entertainment	Education	Social Interaction	Business	Healthcare	Tourism	Real Estate	Shopping	Others
CA and HMD user	69.7%	39.0%	52.3%	26.6%	23.4%	27.9%	16.0%	31.0%	0.0%
CA only user	65.8%	16.3%	42.5%	6.5%	6.0%	9.7%	5.1%	10.2%	0.4%
Overall	67.8%	28.0%	47.5%	16.9%	15.0%	19.1%	10.7%	20.9%	0.2%

n=1776, 1672, 3448

Figure 2.6 CA utilization rates by field (by CA user group and overall)



	Entertainment	Education	Social Interaction	Business	Healthcare	Tourism	Real Estate	Shopping	Others
Japan	65.1%	18.1%	39.0%	12.3%	8.7%	19.0%	7.0%	13.4%	0.0%
South Korea	55.0%	33.6%	40.1%	14.4%	17.3%	16.2%	9.8%	18.5%	0.0%
United States	79.5%	25.2%	57.1%	18.1%	13.3%	18.5%	11.8%	28.4%	0.1%
Germany	70.5%	33.9%	52.2%	22.0%	19.9%	22.6%	13.7%	21.9%	0.6%

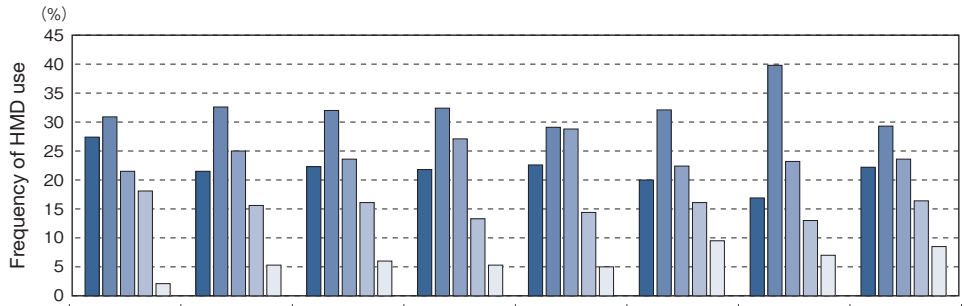
n=767, 871, 925, 885

Figure 2.7 CA utilization rates by field (by country)

Regarding the frequency of HMD use when using CAs, the most common response was "most of the time." In the field of entertainment in particular, 27.4% of respondents answered "every time," suggesting that HMD usage alongside CAs is becoming increasingly common (Figure 2.8).

Regarding the number of days per month CAs were used, entertainment had the highest average (1.37 days), followed by social interaction (0.96 days) (Figure 2.9). A similar trend was observed across countries, with education ranking third in South Korea and Germany, and shopping ranking third in the United States (Figure 2.10).

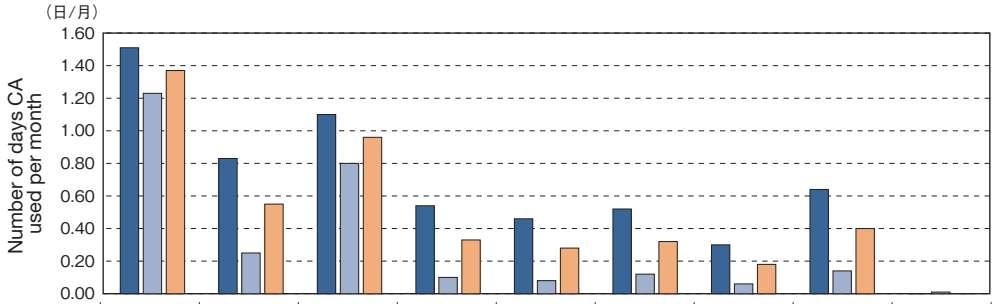
Regarding the number of months since the beginning of CA use, respondents using CAs for entertainment, social interaction, and education tended to have longer usage periods (Figure 2.11). Country-level results show that entertainment had the longest usage duration, followed by social interaction and education (except in the United States, where shopping ranked third), reflecting country-specific usage trends (Figure 2.12).



	Entertainment	Education	Social Interaction	Business	Healthcare	Tourism	Real Estate	Shopping
Every time	27.4%	21.5%	22.3%	21.8%	22.6%	20.0%	16.9%	22.2%
Most of the time	30.9%	32.6%	32.0%	32.4%	29.1%	32.1%	39.8%	29.3%
Half the time	21.5%	25.0%	23.6%	27.1%	28.8%	22.4%	23.2%	23.6%
Sometimes	18.1%	15.6%	16.1%	13.3%	14.4%	16.1%	13.0%	16.4%
Never	2.1%	5.3%	6.0%	5.3%	5.0%	9.5%	7.0%	8.5%

n=1237, 693, 928, 472, 416, 496, 284, 550

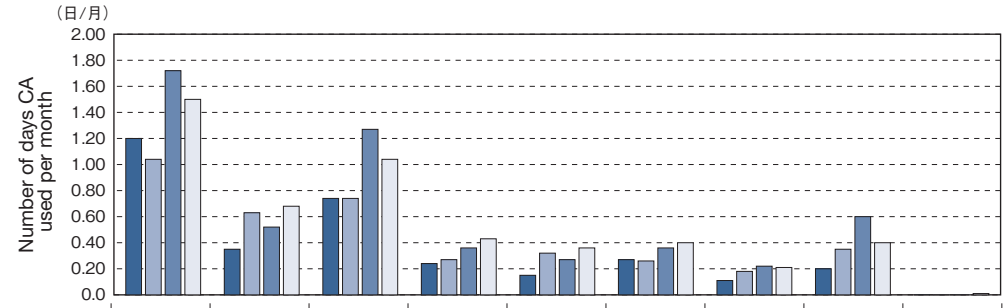
Figure 2.8 Frequency of HMD use by field



	Entertainment	Education	Social Interaction	Business	Healthcare	Tourism	Real Estate	Shopping	Others
CA and HMD user	1.51	0.83	1.10	0.54	0.46	0.52	0.30	0.64	0.00
CA only user	1.23	0.25	0.80	0.10	0.08	0.12	0.06	0.14	0.01
Overall	1.37	0.55	0.96	0.33	0.28	0.32	0.18	0.40	0.00

n=1776, 1672, 3448

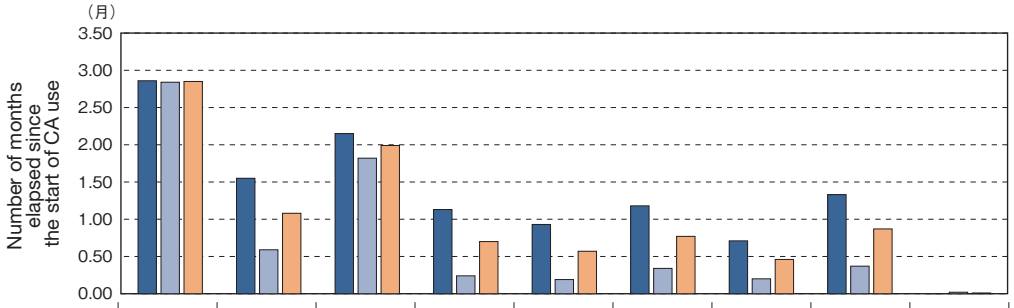
Figure 2.9 Number of days used per month by field (by CA user group and overall)



	Entertainment	Education	Social Interaction	Business	Healthcare	Tourism	Real Estate	Shopping	Others
Japan	1.20	0.35	0.74	0.24	0.15	0.27	0.11	0.20	0.00
South Korea	1.04	0.63	0.74	0.27	0.32	0.26	0.18	0.35	0.00
United States	1.72	0.52	1.27	0.36	0.27	0.36	0.22	0.60	0.00
Germany	1.50	0.68	1.04	0.43	0.36	0.40	0.21	0.40	0.01

n=767, 871, 925, 885

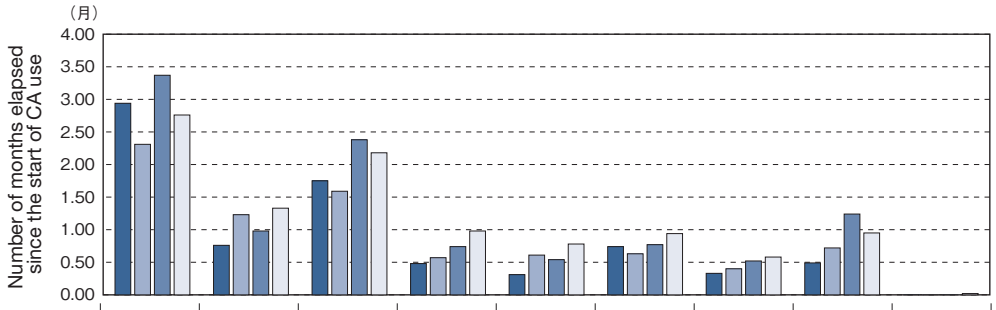
Figure 2.10 Number of days used per month by sector (by country)



	Entertainment	Education	Social Interaction	Business	Healthcare	Tourism	Real Estate	Shopping	Others
CA and HMD user	2.86	1.55	2.15	1.13	0.93	1.18	0.71	1.33	0.00
CA only user	2.84	0.59	1.82	0.24	0.19	0.34	0.20	0.37	0.02
Overall	2.85	1.08	1.99	0.70	0.57	0.77	0.46	0.87	0.01

n=1776, 1672, 3448

Figure 2.11 Number of months elapsed since the start of CA use (by CA user group and overall)



	Entertainment	Education	Social Interaction	Business	Healthcare	Tourism	Real Estate	Shopping	Others
Japan	2.94	0.76	1.75	0.48	0.31	0.74	0.33	0.49	0.00
South Korea	2.31	1.23	1.59	0.57	0.61	0.63	0.40	0.72	0.00
United States	3.37	0.98	2.38	0.74	0.54	0.77	0.52	1.24	0.00
Germany	2.76	1.33	2.18	0.98	0.78	0.94	0.58	0.95	0.02

n=767, 871, 925, 885

Figure 2.12 Number of months elapsed since the beginning of CA use (by country)

2.5. Reasons for not using CAs

When respondents who had never used CAs were asked why, the most common reason was "I do not perceive any clear benefits to using CAs" (29.4%), followed by "I do not feel the need to make new acquaintances or friends through communication using CAs" (25.4%), and "I cannot form a concrete image of what can actually be done with CAs" (25.1%) (Figure 2.13). These results suggest that increasing awareness and clearly communicating the benefits of CAs are crucial for widespread adoption.

By country (Figure 2.14), over 30% of respondents in Japan and Germany cited "I do not perceive any clear benefits to using CAs," while the figure exceeded 25% in South Korea and the United States. In South Korea, the most common reason was "I do not feel the need to make new acquaintances or friends through communication using CAs," whereas in the United States, it was "I cannot form a concrete image of what can actually be done with CAs." Notably, in Japan, a relatively higher proportion of respondents cited a lack of technical knowledge as a barrier. Overall, limited recognition of CAs' advantages and insufficient examples of concrete applications appear to hinder adoption.

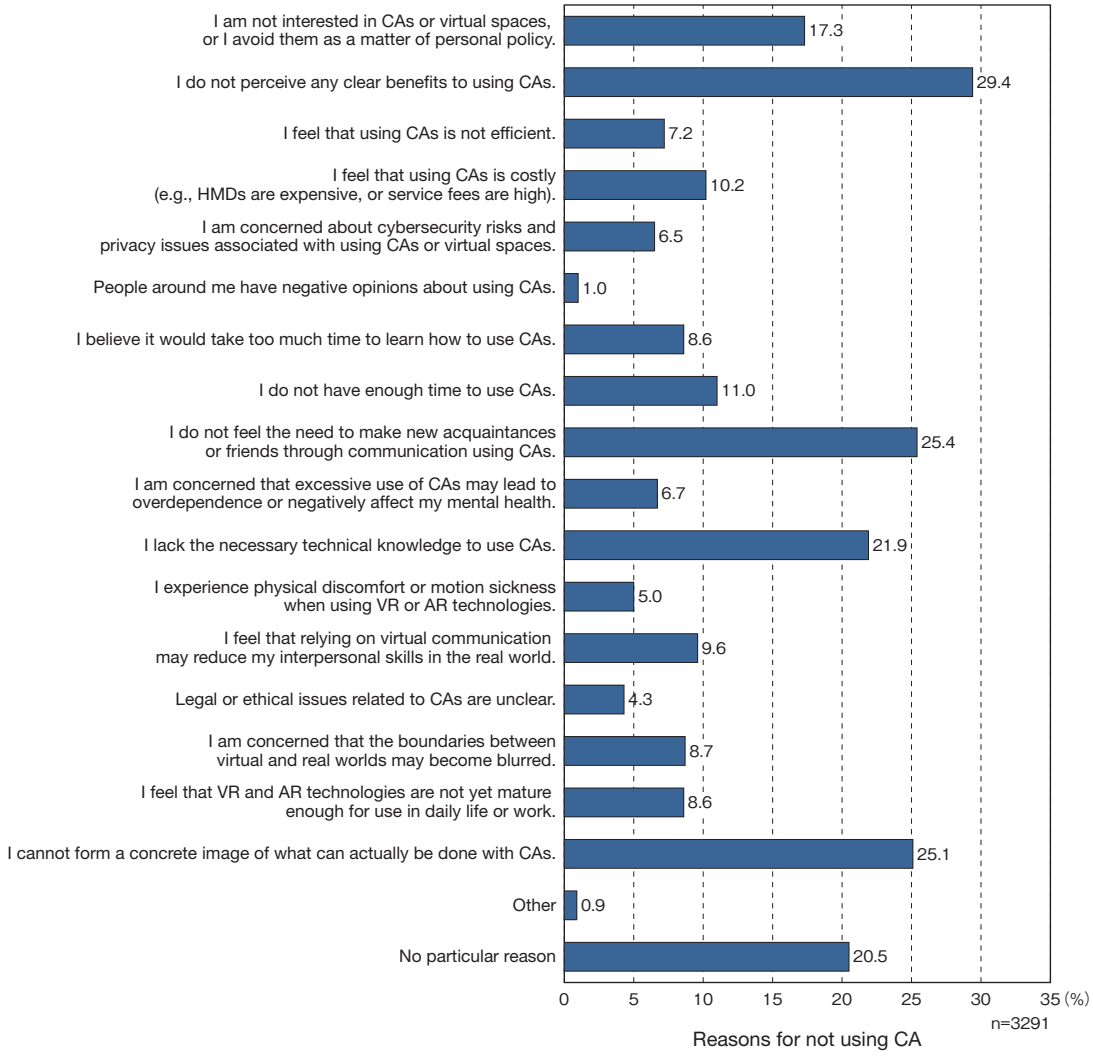


Figure 2.13 Reasons for not using CAs (overall)

Figure 2.14 Reasons for not using CAs (by country)

Reasons for Not Using CAs	Japan	South Korea	United States	Germany	Overall
I am not interested in CAs or virtual spaces, or I avoid them as a matter of personal policy.	14.3%	9.9%	19.4%	27.4%	17.3%
I do not perceive any clear benefits to using CAs.	32.2%	25.8%	27.5%	32.4%	29.4%
I feel that using CAs is not efficient.	4.2%	8.6%	8.3%	8.0%	7.2%
I feel that using CAs is costly (e.g., HMDs are expensive, or service fees are high).	7.0%	11.4%	10.6%	12.4%	10.2%
I am concerned about cybersecurity risks and privacy issues associated with using CAs or virtual spaces.	2.6%	5.5%	9.8%	9.0%	6.5%
People around me have negative opinions about using CAs.	0.0%	0.9%	1.8%	1.5%	1.0%
I believe it would take too much time to learn how to use CAs.	4.7%	7.2%	12.4%	10.8%	8.6%
I do not have enough time to use CAs.	10.6%	10.1%	14.1%	9.2%	11.0%
I do not feel the need to make new acquaintances or friends through communication using CAs.	20.2%	26.7%	23.2%	32.1%	25.4%
I am concerned that excessive use of CAs may lead to overdependence or negatively affect my mental health.	2.7%	5.9%	9.3%	9.7%	6.7%
I lack the necessary technical knowledge to use CAs.	22.0%	19.1%	20.6%	26.3%	21.9%
I experience physical discomfort or motion sickness when using VR or AR technologies.	3.6%	5.3%	5.2%	6.0%	5.0%
I feel that relying on virtual communication may reduce my interpersonal skills in the real world.	2.9%	2.7%	20.5%	14.5%	9.6%
Legal or ethical issues related to CAs are unclear.	2.7%	3.0%	7.4%	4.8%	4.3%
I am concerned that the boundaries between virtual and real worlds may become blurred.	2.8%	4.1%	13.5%	16.1%	8.7%
I feel that VR and AR technologies are not yet mature enough for use in daily life or work.	3.6%	11.6%	10.6%	9.0%	8.6%
I cannot form a concrete image of what can actually be done with CAs.	20.4%	21.4%	29.5%	30.5%	25.1%
Other	1.1%	0.1%	1.2%	1.2%	0.9%
No particular reason	31.0%	22.5%	15.9%	10.4%	20.5%

n=887, 879, 772, 753, 3291

2.6. Potential demand for CAs

When respondents were asked about the fields in which they would like to use CAs in the future—regardless of past usage—the most popular response was "exploring and experiencing historical and cultural sites in virtual spaces" (48.5%), followed by "language learning and international exchange using CAs" (47.7%) and "online gaming experiences using CAs" (47.3%) (Figure 2.15). These results highlight the potential of CAs to offer new experiences in education, entertainment, and tourism.

Interest levels were highest among HMD users, followed by CA-only users, and lowest among non-users (Figure 2.16). Among non-users, the area of highest interest was exploring historical and cultural sites (31.4%), suggesting that practical applications beyond entertainment, such as education and tourism, may help broaden the base of future users.

By country, Japan generally showed lower interest compared to the other countries, although "exploring historical and cultural sites" ranked highest. In South Korea and Germany, "language learning and interna-

tional exchange" was the top response, while in the United States, "online gaming experiences" ranked highest (Figure 2.17). Tourism-related interest was relatively high in all countries except South Korea. Business use in South Korea and virtual real estate tours in Japan and South Korea appeared to be notable areas of interest, reflecting cross-national differences in potential applications.

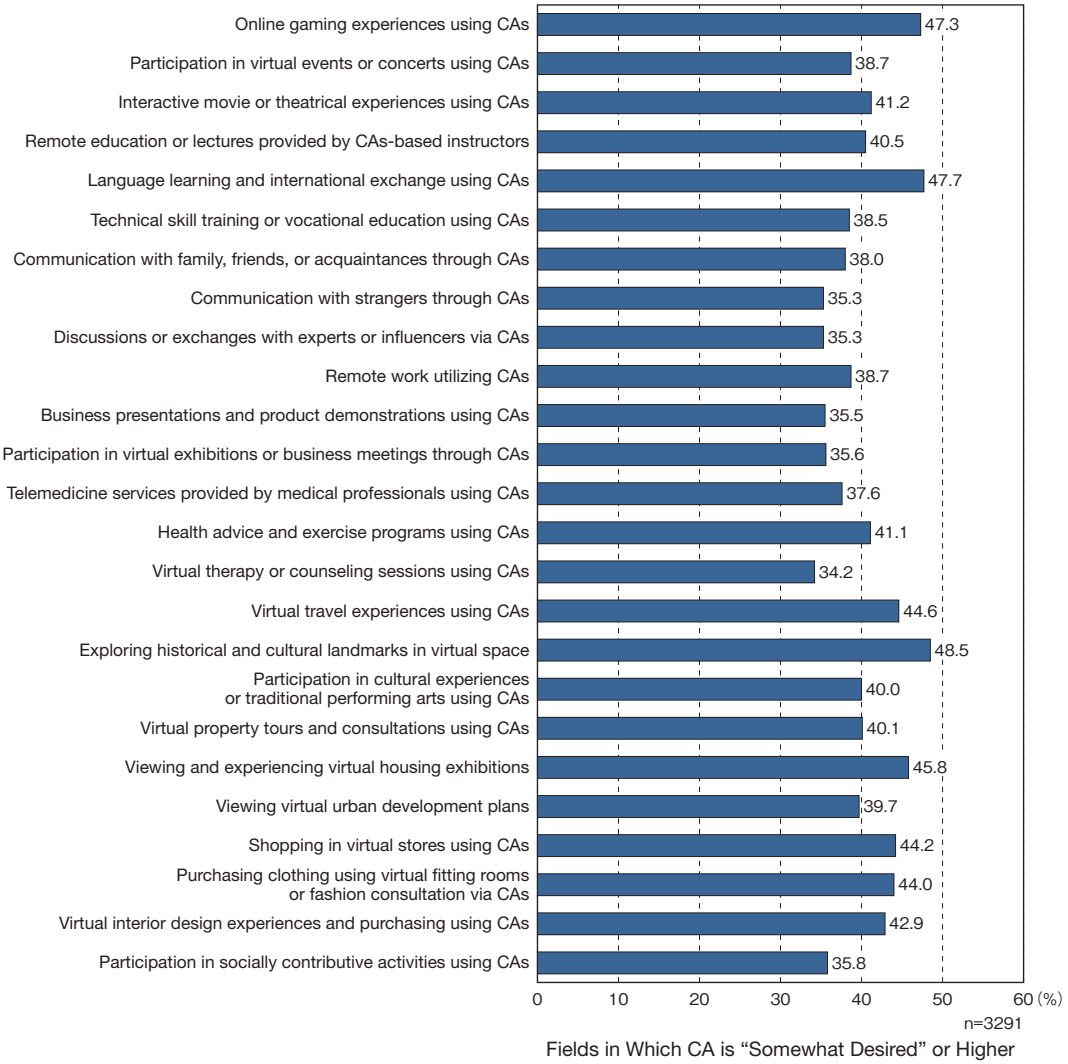


Figure 2.15 Areas in which respondents would like to use CAs (overall)

Figure 2.16 Areas in which CAs would be used (by CA user group and overall)

Fields in Which CAs are "Somewhat Desired" or Higher	CA and HMD user	CA only user	Neither	Total
Online gaming experiences using CAs	77.1%	64.8%	22.4%	47.3%
Participation in virtual events or concerts using CAs	70.2%	42.8%	19.7%	38.7%
Interactive movie or theatrical experiences using CAs	71.2%	45.5%	22.8%	41.2%
Remote education or lectures provided by CAs-based instructors	70.2%	44.4%	22.5%	40.5%
Language learning and international exchange using CAs	72.5%	55.4%	30.4%	47.7%
Technical skill training or vocational education using CAs	67.8%	40.5%	21.7%	38.5%
Communication with family, friends, or acquaintances through CAs	70.2%	42.0%	18.7%	38.0%
Communication with strangers through CAs	66.4%	41.7%	15.3%	35.3%
Discussions or exchanges with experts or influencers via CAs	68.5%	37.1%	16.4%	35.3%
Remote work utilizing CAs	68.6%	42.6%	20.5%	38.7%
Business presentations and product demonstrations using CAs	67.0%	36.9%	17.8%	35.5%
Participation in virtual exhibitions or business meetings through CAs	67.7%	37.3%	17.3%	35.6%
Telemedicine services provided by medical professionals using CAs	66.6%	37.1%	22.2%	37.6%
Health advice and exercise programs using CAs	68.6%	43.3%	25.2%	41.1%
Virtual therapy or counseling sessions using CAs	65.4%	34.8%	17.0%	34.2%
Virtual travel experiences using CAs	70.9%	48.9%	28.1%	44.6%
Exploring historical and cultural landmarks in virtual space	73.1%	56.0%	31.4%	48.5%
Participation in cultural experiences or traditional performing arts using CAs	70.0%	43.7%	22.0%	40.0%
Virtual property tours and consultations using CAs	68.1%	41.7%	24.1%	40.1%
Viewing and experiencing virtual housing exhibitions	70.3%	51.4%	29.8%	45.8%
Viewing virtual urban development plans	70.0%	42.0%	22.2%	39.7%
Shopping in virtual stores using CAs	72.5%	49.2%	26.4%	44.2%
Purchasing clothing using virtual fitting rooms or fashion consultation via CAs	69.7%	48.2%	28.0%	44.0%
Virtual interior design experiences and purchasing using CAs	72.0%	46.7%	25.3%	42.9%
Participation in socially contributive activities using CAs	67.5%	38.1%	17.4%	35.8%

n=1776, 1672, 3291, 6739

Figure 2.17 Areas of interest in using CA (by country)

Fields in Which CAs are "Somewhat Desired" or Higher	Japan	South Korea	United States	Germany	Overall
Online gaming experiences using CAs	32.0%	48.1%	55.9%	53.0%	47.3%
Participation in virtual events or concerts using CAs	29.8%	38.1%	46.2%	40.6%	38.7%
Interactive movie or theatrical experiences using CAs	30.8%	44.0%	47.6%	42.1%	41.2%
Remote education or lectures provided by CAs-based instructors	27.4%	45.8%	43.9%	44.7%	40.5%
Language learning and international exchange using CAs	30.7%	52.9%	50.6%	56.3%	47.7%
Technical skill training or vocational education using CAs	28.5%	42.7%	44.3%	38.2%	38.5%
Communication with family, friends, or acquaintances through CAs	26.7%	37.4%	50.1%	37.6%	38.0%
Communication with strangers through CAs	24.4%	35.0%	42.4%	39.5%	35.3%
Discussions or exchanges with experts or influencers via CAs	23.0%	37.3%	42.1%	38.4%	35.3%
Remote work utilizing CAs	25.9%	50.5%	42.1%	35.6%	38.7%
Business presentations and product demonstrations using CAs	24.2%	41.4%	37.6%	38.5%	35.5%
Participation in virtual exhibitions or business meetings through CAs	24.3%	40.6%	38.7%	38.3%	35.6%
Telemedicine services provided by medical professionals using CAs	30.4%	40.5%	38.1%	41.2%	37.6%
Health advice and exercise programs using CAs	29.5%	47.5%	42.2%	44.9%	41.1%
Virtual therapy or counseling sessions using CAs	26.1%	33.8%	37.5%	39.3%	34.2%
Virtual travel experiences using CAs	34.3%	43.8%	51.6%	48.5%	44.6%
Exploring historical and cultural landmarks in virtual space	37.4%	48.6%	53.9%	54.2%	48.5%
Participation in cultural experiences or traditional performing arts using CAs	27.8%	44.3%	45.7%	41.9%	40.0%
Virtual property tours and consultations using CAs	28.5%	40.5%	45.6%	45.5%	40.1%
Viewing and experiencing virtual housing exhibitions	32.9%	48.8%	51.0%	50.4%	45.8%
Viewing virtual urban development plans	29.7%	38.4%	44.9%	45.8%	39.7%
Shopping in virtual stores using CAs	32.0%	46.7%	51.2%	46.6%	44.2%
Purchasing clothing using virtual fitting rooms or fashion consultation via CAs	29.4%	46.4%	50.1%	49.8%	44.0%
Virtual interior design experiences and purchasing using CAs	25.3%	47.3%	48.2%	50.5%	42.9%
Participation in socially contributive activities using CAs	25.8%	35.9%	45.0%	36.0%	35.8%

n=1654, 1750, 1697, 1638, 6739

3

Social transformation brought about by CAs (international comparison)

3.1. Social transformation brought about by CAs

Social transformation enabled by CA has been highlighted in various academic and policy studies. In this chapter, we review both domestic and international sources on the social impact of CAs and summarize the key dimensions of this transformation.

3.1.1. Positive social change brought about by CAs

3.1.1.1. Alleviating physical and social constraints/creating new experiences

Reduction of travel burden	The White Paper on Land, Infrastructure, Transport and Tourism notes that while digital virtual spaces cannot fully replace physical movement, they are valued for "reducing the need for physical travel and enabling access to distant tourist and commercial facilities."[9]

3.1.1.2. Contribution to regional revitalization and industrial development

Applications in the tourism and commercial sector	Initiatives promoting tourism through extended reality (XR) and the metaverse demonstrate growing momentum in using virtual events and avatar-based remote customer service to promote local brands.

3.1.1.3. Contribution to industrial development

Accelerating business innovation	An increasing number of major corporations and local governments are offering services in the metaverse. Branded companies are also selling digital goods for CAs on platforms such as Roblox. For these companies, CAs serve as a new customer touchpoint, and the expansion of digital products and services is expected to drive transformations in business models.
Fusion across disciplines	Designing virtual objects such as CA outfits enables a high degree of creative freedom. This is expected to allow professionals such as fashion and jewelry designers to transcend disciplinary boundaries and participate as content creators.[10]

9. Ministry of Land, Infrastructure, Transport and Tourism. (2023). *White Paper on Land, Infrastructure and Transport 2023.* https://www.mlit.go.jp/statistics/hakusyo.mlit.r5.html
10. Intellectual Property Strategy Headquarters, Prime Minister's Office. (2022). *Intellectual Property Strategic Plan 2022 (Draft).* https://www.kantei.go.jp/jp/singi/titeki2/220603/siryou2.pdf

Emergence of creative talent	In 2022, more than 11.5 million creators designed over 62 million virtual clothing items and accessories on Roblox. These creators—who contribute to CA development and world-building—represent a new creative workforce and are driving the emergence of new forms of employment.[11]

3.1.1.4. Transformation and expansion of social participation

Discovering diverse talent	The Tourism Division of the Culture, Sports, and Tourism Department of Yokosuka City has launched a tourism strategy named "Metaverse Yokosuka," aimed at enhancing the city's appeal through the development of a metaverse. A related initiative encourages citizens to acquire skills and become active as creators. Greater social participation by people with disabilities is also anticipated.[12]
Emergence of new forms of civic engagement	Urban digital twins are expected to serve as practical communication tools connecting residents with governments and developers. These tools can support inclusive planning and engagement.[13] The European Commission is currently developing the "Local Digital Twins & CitiVERSE (LDT CitiVERSE EDIC)," a platform where EU industries and Small and Medium-sized Enterprises can use trustworthy AI and virtual reality tools to create sustainable urban environments through diverse data-driven services. CitiVERSE is defined as an "interconnected, distributed, and hybrid virtual world." In this space, digital avatars represent urban and community stakeholders (e.g., citizens) and have access to new forms of governance, economic activity, social interaction, policymaking, and virtual goods and services.[14]

3.1.1.5. Alleviating physical and social constraints

Reducing technology barriers	Individuals and companies will be able to design and use AI tailored to their specific requirements. Even users without expertise can easily access specialized knowledge by interacting with an AI avatar that has learned the thoughts and knowledge of a particular individual.[15]

11. Roblox. (2022). *Metaverse Fashion Trends 2022.* https://cdn.buttercms.com/MZTykPwjSgq0cP9IsExS
12. Kanagawa Policy Research Center. (2024). *Research Report Utilization of Metaverse and Web3 in Municipal Policies.* https://www.pref.kanagawa.jp/documents/107122/04_journal17-center-report.pdf.
13. Ministry of Land, Infrastructure, Transport and Tourism. (2023). *White Paper on Land, Infrastructure and Transport 2023.* https://www.mlit.go.jp/statistics/hakusyo.mlit.r5.html
14. European Commission: Directorate-General for Research and Innovation, (2024). *Emerging digital technologies in the public sector: the case of virtual worlds,* Publications Office of the European Union. https://data.europa.eu/ doi/10.2777/398037
15. Kashiwamura, Yu. (2023). The Impact of AI Avatars: Creating a Virtual IT Analyst to be Yourself. *Dai-ichi Life Institute Life Design Report.* Dai-ichi Life Institute. https://www.dlri.co.jp/report/ld/290355.html

3.1.1.6. Evolving forms of self-actualization

Expression of the ideal self	In the metaverse, users do not just choose their ideal appearance; they also reflect on the kind of person they want to be. According to surveys, 40% of Generation Z (Gen Z) feel they can express their authentic selves more easily in the metaverse than in the physical world, citing "freedom of expression" and "creative possibilities" as key reasons.[16] Moreover, many Gen Z individuals prioritize looking good for themselves rather than for others in the metaverse. When selecting their avatar's appearance, 62% reported that they care deeply about how it looks to them, while only 37% said they care deeply about how it looks to others.[17]
Identity transformation	CAs are seen as capable of reshaping a user's identity. They enable users to freely create and adjust personal traits and characteristics, and even to customize communication styles to suit others' preferences. CAs are also expected to reduce unethical behavior and promote positive behavioral changes.[18]
Building confidence	On platforms such as Roblox, community members often connect and respond to others based on appearance and clothing. These dynamics can significantly influence users' self-confidence and interpersonal relationships.[19]

3.1.2. Negative social change brought about by CAs

3.1.2.1. Risks to privacy and personal information protection

Identity theft	In the metaverse, issues have arisen concerning personality rights when avatars are used by others without consent or against an individual's will. These issues include violations of privacy related to CA use. An appropriate identity management framework is essential in the metaverse. Measures include identity verification technologies, third-party authentication systems, and avatar registration mechanisms. In particular, introducing an avatar registration system is viewed as a potential method to prevent impersonation.[20]

16. Helix Lab. (2023). *Metaverse as Possible Futures.* https://www.hakuhodody-holdings.co.jp/news/corporate/assets/uploads/Metaverse_as_Possible_Futures.pdf
17. Roblox. (2023). *Insights From Our Latest Digital Expression, Fashion & Beauty Trends Report.* https://cdn.buttercms.com/XJdltBTSNW3kuwiVCqJU
18. Kukita, M. (2021). *Avatars and the Future of Communication. Artificial Intelligence. 36*(5), 585-592. https://www.jstage.jst.go.jp/article/jjsai/36/5/36_585/_pdf/-char/ja
19. Roblox. (2022). *Metaverse Fashion Trends 2022.* https://cdn.buttercms.com/MZTykPwjSgq0cP9IsExS
20. Ishii, K. (2022). Legal issues surrounding avatar impersonation: From the viewpoint of privacy protection. *Journal of Information and Communication Policy, 6*(1), 1-20. https://doi.org/10.24798/jicp.6.1_1

Concerns about privacy leaks	Two main risks are raised: (1) Leaks of personal information caused by impersonated CAs or malicious programs. (2) Monetization of highly sensitive personal data through CA-related services.[21]

3.1.2.2. Harassment and expression of violence

Incidents of harassment	On platforms such as Meta's Horizon Worlds and Horizon Venues, harassment targeting avatars—especially those with female appearances or voices—has become common. Reports include mass sexual assault, groping, and comments of a sexual, homophobic, or racist nature. Women, in particular, have frequently been the targets of such attacks.[22]
Delayed anti-harassment measures	Concerns have been raised regarding verbal abuse, unwanted advances, harassment, invasion of CA-related privacy, and cheating. However, current user authentication systems and behavioral restrictions provided by platforms remain insufficient.[23] While some platforms have introduced new safety features, such as personal safety bubbles, researchers from SumOfUs reported that users were encouraged or even pressured by others to disable these settings. This raises concerns about the limited effectiveness of platform-based countermeasures.

3.1.2.3. Lack of legal protection

Inadequate protection of minors	Minors can easily access metaverse platforms within minutes by using a parent's or sibling's account or by creating a fake Facebook account claiming to be 18 or older. According to the Center for Countering Digital Hate, users, including minors, are exposed to abusive behavior on VRChat approximately every seven minutes. Reported issues include bullying, harassment, racism, extremism, exposure to pornography, and grooming. Experts have expressed concern that the failure to enforce community guidelines and respond to user complaints enables sexual predators to target children.[24]
Lack of legal rights for CAs	Currently, CAs are not recognized as legal people. Additionally, publicity rights for virtual objects are generally not acknowledged. As a result, legal protections for virtual assets created in virtual spaces remain an unresolved issue.[25]

21. Japan Research Institute. (2024). *Analysis of the Impact of the Diffusion of VR Devices and the Evolution of UI/UX Summary of Survey Results* (Ministry of Internal Affairs and Communications, "Study Group on Realization of Safe and Secure Metaverse (7th Meeting)" Handout). https://www.soumu.go.jp/main_content/000947595.pdf
22. SumOfUs. (2022). *Metaverse: another cesspool of toxic content.* https://www.eko.org/images/Metaverse_report_May_2022.pdf
23. Center for Research and Development Strategy, National Institute of Science and Technology Agency. (2023). *Potential and Challenges of Metaverse as a Social Infrastructure.* https://www.jst.go.jp/crds/pdf/2023/RR/CRDS-FY2023-RR-04.pdf
24. Center for Countering Digital Hate. (2024). *Fake Image Factories.* https://counterhate.com/research/fake-image-factories/
25. KPMG Consulting. (2021). *Report: FY2020 Project for the Promotion of Contents Overseas Development (Survey and Analysis Project on the Future Possibilities and Issues of Virtual Space).* https://www.meti.go.jp/meti_lib/report/2020FY/000692.pdf

Immature social consensus on AI avatars of the deceased	Concerns have arisen that bots or avatars could be created using stolen or publicly available data without consent. Critical questions remain, including whether such simulations should be allowed in the absence of explicit approval from the deceased. Looking ahead, social frameworks may need to incorporate provisions in wills governing the use of personal data for simulation purposes.[26]

3.1.2.4. Widening economic disparity

The digital divide	Access to the metaverse requires high-performance devices and fast internet connections. This raises the risk of disparities in access based on region or income level, which could deepen inequalities in social participation, education, and employment opportunities.

3.1.2.5. Concerns about information manipulation and disinformation

Overemphasis on stereotypes	Excessive emphasis on female stereotypes and limited diversity raise concerns. Dove, in collaboration with the NGO Women in Games and the Centre for Appearance Research, conducted a study on the portrayal of girls and women in video games. The results show that 60% of female gamers felt women were misrepresented and recognized the lack of diversity as a major problem in video games. Furthermore, 35% of young women reported that the limited diversity in characters and avatars negatively affected their self-esteem.[27] [28]
Deliberate manipulation of information	A video circulated on social media in which a fictitious person, posing as a news anchor, presented news supporting the Chinese Communist Party. The video is believed to have been produced by Chinese authorities.[29] According to a study by the Center for Countering Digital Hate, Midjourney's public database of AI-generated images has already been exploited by malicious actors to create images that may support election-related disinformation. These AI-generated images have caused confusion on social media platforms and spread widely before being identified as fake.[30]

26. THEOS. (2024). *AI and the Afterlife: From Digital Mourning to Mind Uploading.* https://www.theosthinktank.co.uk/research/2024/02/15/ai-and-the-afterlife- from-digital-mourning-to-mind-uploading
27. Maybelline New York. (2023). *Under The Avatar.* https://www.maybelline.com.au/make-up-make-change/under-the-avatar
28. Woman in Games. (2022). *REAL VIRTUAL BEAUTY: WOMEN IN GAMES TEAMS WITH DOVE AND EPIC GAMES ON INDUSTRY-FIRST INITIATIVE.* https://www.womeningames.org/real-virtual-beauty -women-in-games-teams-with-dove-and-epic-games-on-industry-first-initiative/
29. Graphica. (2023). *Deepfake It Till You Make It.* https://graphika.com/reports/deepfake-it-till-you-make-it
30. Center for Countering Digital Hate. (2024). *Fake Image Factories II.* https://counterhate.com/research/fake-image-factories-ii/

Concerns about election influence by generated AI avatars	According to the OECD's AI Incident Monitor, reported incidents involving "computer-generated images" have increased by 440% year over year. In May 2024, tests of popular AI image generation technologies using fake images of U.S. and EU politicians showed that Midjourney's "AI Moderator" produced misleading images in 40% of cases. Furthermore, tests involving Joe Biden and Donald Trump revealed misleading images in 50% of instances. Although Midjourney has announced policies to combat fake images generated by generative AI, these measures have largely proven ineffective.[31]

3.1.2.6. Effects on the mind and body

Negative impact on mental health, such as feeling a gap between one's CA and real self	Mental impacts and challenges include potential negative effects on mental health. In particular, some children may experience psychological strain due to a discrepancy between their CA in VR and their real-life selves.[32]
Dependence on virtual worlds	Consumers may become dependent on enhanced virtual worlds as a way to escape difficulties in their daily lives. This dependence can affect psychological factors such as self-esteem and confidence, potentially leading to undesirable behaviors, including impulse buying.[33]

3.1.3. Utilizing CAs to address Japan's social issues

The literature review also suggests that CAs can contribute significantly to addressing Japan's social issues.

Promoting these forms of social applications requires urgently establishing usage rules and guidelines led by public institutions and relevant industry associations, while ensuring privacy and security. In South Korea, "Ethical Principles for the Metaverse" have been published, and efforts are underway to address issues arising from CA anonymity. Similarly, in Japan, creating an environment in which users can utilize CAs and metaverse services with confidence requires cooperation among relevant ministries—including the Ministry of Internal Affairs and Communications, the Ministry of Economy, Trade and Industry, and the Ministry of Education, Culture, Sports, Science and Technology—as well as private enterprises and NPOs.

31. Center for Countering Digital Hate. (2024). *Fake Image Factories II.* https://counterhate.com/research/fake-image-factories-ii/
32. Japan Research Institute. (2024). Analysis of the Impact of the Diffusion of VR Devices and the Evolution of UI/UX Survey Results Summary. https://www.soumu.go.jp/main_content/000947595.pdf
33. Koohang, A. et al. (2023). Shaping the Metaverse into Reality: A Holistic Multidisciplinary Understanding of Opportunities, Challenges, and Avenues for Future Investigation. *Journal of Computer Information Systems, 63*(3), 735-765. https://doi.org/10.1080/08874417.2023.2165197

3.1.3.1. Contribution to regional revitalization and increasing exchange population

Industry creation	Oita Prefecture has been conducting demonstration experiments with avatar technology since around 2018. In 2021, a company in the prefecture announced the start of mass production of CA robots. The following year, in 2022, it launched the CA project "HELLO FUTURE! 2022." In addition to supporting local companies in addressing operational challenges through the use of CAs, the project has actively contributed to fostering new industries and promoting the use of educational CAs in elementary and junior high schools. That same year also saw several citizen-participation initiatives, such as "Oita Avatar Learn," a meetup-style event where businesspeople and students gathered to explore the use of CAs.[34] [35] [36]
Expansion of exchange population	By utilizing virtual spaces, people can experience tourist sites and commercial facilities that are normally inaccessible owing to physical limitations. This is expected to have various effects contributing to regional revitalization, including the stimulation of travel and consumer demand, which may lead to an increase in the number of people engaging with the region.[37] The town of Meiwa in Mie Prefecture opened its original metaverse space, "Music Fest World feat. MEIWA," for a limited period from January 24 to February 21, 2024. The project featured original official CAs and content showcasing the town's specialties and landscapes. As a result, the total number of visitors—including those from Japan, Asia, Europe, and North America—exceeded 1.7 million.[38] In 2023, Tottori Prefecture established Japan's first "Metaverse Section" within a local government. Its PR avatar staff is expected to evolve to provide personalized tourist recommendations and multilingual interpretation for foreign visitors. In 2024, the prefecture launched its own metaverse space, "Virtual Tottori," and held a virtual social event titled "Virtual Alumni Association '33 Festival'" for people in their early 20s to late 30s with ties to Tottori, aiming to further expand the connected population.[39] [40]

34. Oita Pref. (2020). Social Implementation Initiatives for Avatar Prefecture Oita. https://www.chisou.go.jp/tiiki/toshisaisei/mini_symposium/20211216/04_r3dai3kai_03ooitaken_kouensiryou.pdf
35. HELLO FUTURE! (2024). *Call: Call for Participating Companies in the Avatar Robot Introduction Demonstration Project (FY2024 Avatar Technology Industry Creation Promotion Project).* https://avataroita.jp/news/610/
36. Oita Pref. (2022). *The 2022 "Avatar Utilization Creation School" will be held!* https://www.pref.oita.jp/site/oita-iot-lab/avatarjuku2022.html
37. Ministry of Land, Infrastructure, Transport and Tourism. (2023). *White Paper on Land, Infrastructure and Transport 2023.* https://www.mlit.go.jp/statistics/hakusyo.mlit.r5.html
38. AVITA. (2024). *Increased local government related population by more than 1.7 million people through the use of avatars and generative AI! Local Development Project in Meiwa Town, Mie Prefecture.* https://prtimes.jp/main/html/rd/p/000000051.000085375.html.
39. Metaverse Research Institute. (2023). *Why Tottori Prefecture, with the smallest population, is moving forward with metaverse utilization faster than any other prefecture.* https://metaversesouken.com/metaverse/tottori/
40. Jichitai Works WEB. (2024). *Tottori Prefecture: creating a relevant population by disseminating information from the metaverse.* https://jichitai.works/article/details/2626

3.1.3.2. Support for education and reskilling

Support for children not attending school	Increasing examples of metaverse-based education services support children who are not attending school. In public elementary and junior high schools in Koganei City, a metaverse-based educational program for non-attending children underwent evaluation for its effectiveness. A survey found that 52% of the 29 participating children showed positive changes, including increased engagement with classes and daily activities, reduced anxiety in interpersonal situations, and a greater sense of structure in their lives. The survey also indicated that children recognize virtual spaces as "a learning option and a place to belong" for those who have withdrawn from school.[41]
Reskilling support	Participants join via CAs, so their appearance and background remain invisible to others. This setup is expected to reduce instances of bullying and revitalize the reskilling market by making relearning more accessible.

3.1.3.3. Securing specialized human resources

Securing specialized human resources	Services that facilitate the preservation of skills and knowledge held by specialized personnel for future generations and enable easier access to their expertise are being developed. For example, a retiring employee may create a CA that the organization can continue to access after their departure. New services may also emerge to improve access to expert knowledge. These developments could give rise to a new industry offering tailor-made digital consulting services using CAs of lawyers, scholars, intellectuals, and artists.[42]

3.1.3.4. Employment support and promotion of flexible work styles

Promotion of remote work and flexibility in work styles	Utilizing the metaverse helps to bridge the gap between physical offices and virtual workspaces. In a metaverse environment, individuals will be able to work remotely from anywhere in the world through digital avatars. This is expected to create more flexible work styles and bring a new dimension to workplace practices and human resource management.[43]

41. Ministry of Education, Culture, Sports, Science and Technology. (2023). *FY2022 Project for Promotion of Utilization of Advanced Technology and Educational Data for Next-Generation Schools and Educational Sites [Research theme] Examining the Effectiveness and Challenges of the Educational Metaverse as a Countermeasure against School Failure and its Future Potential.* https://www.mext.go.jp/content/20230315-mxt_shoto01-100013299_001.pdf
42. THEOS. (2024). *AI and the Afterlife: From Digital Mourning to Mind Uploading.* https://www.theosthinktank.co.uk/research/2024/02/15/ai-and-the-afterlife- from-digital-mourning-to-mind-uploading
43. Koohang, A. et al. (2023). Shaping the Metaverse into Reality: A Holistic Multidisciplinary Understanding of Opportunities, Challenges, and Avenues for Future Investigation. *Journal of Computer Information Systems, 63*(3), 735-765. https://doi.org/10.1080/08874417.2023.2165197

Creation of avatar workers	In Meiwa Town, Mie Prefecture—where the town developed its own metaverse space—the "Meiwa Avatar Center" was established. The town has created an environment that allows residents to work as CAs and has trained a total of 270 people as CA workers. In parallel, the town has provided junior high school students with career experience opportunities, including customer service training in social welfare facilities.[44]

3.1.3.5. Applications in the medical and welfare fields

Preventing isolation	Proposals suggest that the metaverse can serve as a platform to address issues of isolation and loneliness. As a pioneering example, Helix Lab reported on a Japanese startup that hosted a "metaverse clinic" to help alleviate loneliness. By providing a space for interaction, the metaverse can reduce users' feelings of isolation and contribute to maintaining mental health. It may also enhance well-being, including life satisfaction and psychological fulfillment.[45]
Use in telemedicine and nursing care	CA-based communication is attracting attention in areas such as telemedicine and nursing care. For example, virtual health consultations and rehabilitation guidance could supplement home visits, significantly reducing travel burdens for residents in depopulated areas or those requiring care. However, handling medical data requires advanced security measures, so platforms and service providers must proactively ensure compliance with legal frameworks.

3.1.3.6. Utilization for environmental protection

Reducing clothing return rates	Improvements in CA-based fitting technology will enable customers to find the correct size before purchasing. In the fashion industry, addressing the high rate of returns is an urgent issue, and CAs are expected to help alleviate it. According to Bods, items that include a 3D fitting tool have not required bracketing (i.e., buying multiple sizes and returning the extras), demonstrating the effectiveness of CAs.[46]
Promoting understanding of social issues	Educational content that enables users to learn about social issues—such as environmental or human rights concerns—while playing is becoming increasingly available. In January 2023, H&M opened "Loooptopia" on Roblox. Within this creative and playful environment, users can learn about fashion and circular economies.[47]

44. AVITA. (2024). *Increased local government related population by more than 1.7 million people through the use of avatars and generative AI! Local Development Project in Meiwa Town, Mie Prefecture.* https://prtimes.jp/main/html/rd/p/000000051.000085375.html.
45. Helix Lab (Hakuhodo DY Holdings, MESON). (2023). *Metaverse as Possible Futures.* https://www.hakuhodody-holdings.co.jp/news/corporate/assets/uploads/Metaverse_as_Possible_Futures.pdf
46. McDowell, M. (2024). *Want to reduce returns? Avatars might be the answer.* VOGUE Business. https://www.voguebusiness.com/story/technology/want-to-reduce-returns-avatars-might-be -the-answer
47. McNamara, C. (2023). *H&M's Loooptopia: new routes to brand engagement.* GEEIQ. https://geeiq.com/hms-looooptopia-new-routes-to-brand-engagement/

3.1.4. Current state and near future of CAs/Forecast toward 2040

3.1.4.1. Overview of future projections for CAs

Currently, the economic value of items related to CAs is increasing, particularly in fashion, advertising, and gaming, with active marketing primarily targeting Gen Z. On VR platforms such as Roblox, fashion and cosmetics brands sell virtual fashion items, and user-generated content is also gaining popularity. These trends appear in the development of new consumer products, the emergence of new creators, and the growing popularity of CA models and brands, indicating that the CA fashion sector is beginning to gain momentum.

The VR usage rate among Gen Z is higher than that of other generations, and sales of products and services aimed at this group are strong. In response, appeals using CAs are being actively conducted in elections worldwide. For example, in South Korea and Indonesia, candidates using CAs increased their familiarity with younger voters, and those who implemented CA strategies early—through advertisements, videos, games, and other media—have successfully won elections. Although China has not yet seen significant changes in voting behavior, CA anchor videos and fake video campaigns targeting the Taiwanese presidential election have been observed.

Following the COVID-19 pandemic, attempts to provide tourism experiences through VR have been observed both in Japan and abroad. Service providers are not limited to corporations; local governments, particularly smaller municipalities rather than prefectural-level entities, are increasingly taking the lead. These initiatives show signs of expanding efforts to revitalize communities and create new industries, with growth in related populations expected both domestically and internationally. Additionally, the participation of diverse human resources in CA production is expected to contribute to job creation. Future challenges include training content creators and building institutional know-how within local governments to use CAs as tools for regional revitalization.

A "change in self-actualization" at the individual level can be considered a positive social transformation. Through CAs, users tend to express their preferred selves more freely than in the real world, prioritizing how they see themselves over how others perceive them. Many also report feeling more comfortable in the virtual space and find communication easier, suggesting that self-expression is enriched through CAs.

3.1.4.2. Projections for the near future

The Future Today Institute summarizes current and future trends in science and technology. According to this source, in the near future, AI, including generative AI, and XR technologies such as augmented reality (AR) and VR are expected to impact all sectors of society, including industry, education, media, and defense. If CAs are regarded as part of AI, generative AI, or XR, their application could expand further into a variety of fields.[48]

A technology forecast related to the metaverse is the emergence of "hyperrealistic avatars." These highly detailed CAs faithfully replicate individuals' actual facial features, expressions, and movements using advanced 3D modeling and scanning technologies. This technology is expected to enable personalized brand

48. Future Today Institute. (2024). *Tech Trends Report.* https://ftsg.com/

experiences and significantly transform how people express themselves and interact online. However, to maximize brand experiences and extend user engagement with the metaverse, various technological developments are necessary, one of which is enabling the migration of CAs across different platforms. The Future Today Institute predicts that CA migration between platforms will be realized within five to nine years. Furthermore, with the advancement of metaverse platform technologies, interoperability is expected by 2040, allowing most people to no longer distinguish between CAs operated by humans and those operated by AI. However, such technological progress may raise concerns about "convincing impersonations and even more malicious acts." By 2040, VR spaces are expected to feature not only CAs modeled on real individuals but also various other types of CAs, including those representing the deceased, which increases the importance of addressing ethical issues.

3.1.4.3. 2040 projections and challenges

The expansion of CA use, along with the associated issues and forecasts, depends not only on technological advancement but also on societal acceptance, legal frameworks, and responses from platform providers. Expert forecasts indicate that the spread of metaverses, XR, and CAs may remain limited.[49] According to certain 2040 projections, AR and mixed reality (MR) tools will become commonplace, whereas VR will be used only in specific areas such as entertainment, work, and education/training. Observations indicate that, while some users may become so immersed in the metaverse that they perceive their CAs as more real than themselves, such users are likely to remain a minority.

To enable broader CA use, both technological advancements and the development of legal frameworks are essential. In particular, for a metaverse centered on AR and MR to become more widespread, substantial evolution is required in software, hardware, user interfaces, and network capacity. For example, developing a technological environment that allows everyone to use CAs without network delays or access barriers is necessary.

At the same time, protecting CAs and the rights of CA users through legal measures is important. Currently, issues such as copyright infringement and identity theft have surfaced. Corporate responses and the establishment of rules are also urgently needed to enhance safety in metaverse spaces, addressing issues such as defamation, sexual abuse, and inappropriate use by minors. Furthermore, as mentioned earlier, technical solutions are required to address usability issues caused by the need for users to employ different CAs on different platforms.

Currently, CAs are used in game platforms, live music events, business operations, and regional development. In the future, usage is expected to evolve toward applications in a wide range of fields, though initially by a limited number of enthusiastic users. However, the advancement of such uses cannot proceed without technological and legal developments. Improvements in the CA environment are anticipated to play a critical role in determining public acceptance and widespread utilization. If support measures and actions by service providers fail to progress, CA use may become polarized, and utilization could remain limited.

The positive and negative trends in the current situation, along with future projections, are summarized in Figure 3.1. Currently, technologies related to AI and XR are advancing, resulting in diverse CA use cases. CAs are mainly used by Gen Z users abroad, with trends emerging such as buying and selling fashion items,

49. Anderson, J. and Rainie, L. (2022). *The Metaverse in 2040.* Pew Reserch Center. https://www.pewresearch.org/internet/2022/06/30/the-metaverse-in-2040/

communicating, and influencing popularity. Positive outcomes have also been reported in areas such as education and tourism. If these developments proceed smoothly, they may stimulate various changes, including shifts in self-expression and communication, progress in business, diversification of social participation, and the democratization of expertise. However, numerous negative issues have also been identified, including dissatisfaction with virtual spaces and CAs, the need to use different CAs on each platform, and harassment. If these issues are not addressed through legal frameworks or regulations by service providers, problems may persist and diversify, potentially creating barriers to CA use. In addition to hindering adoption, negative effects could also extend to the real world.

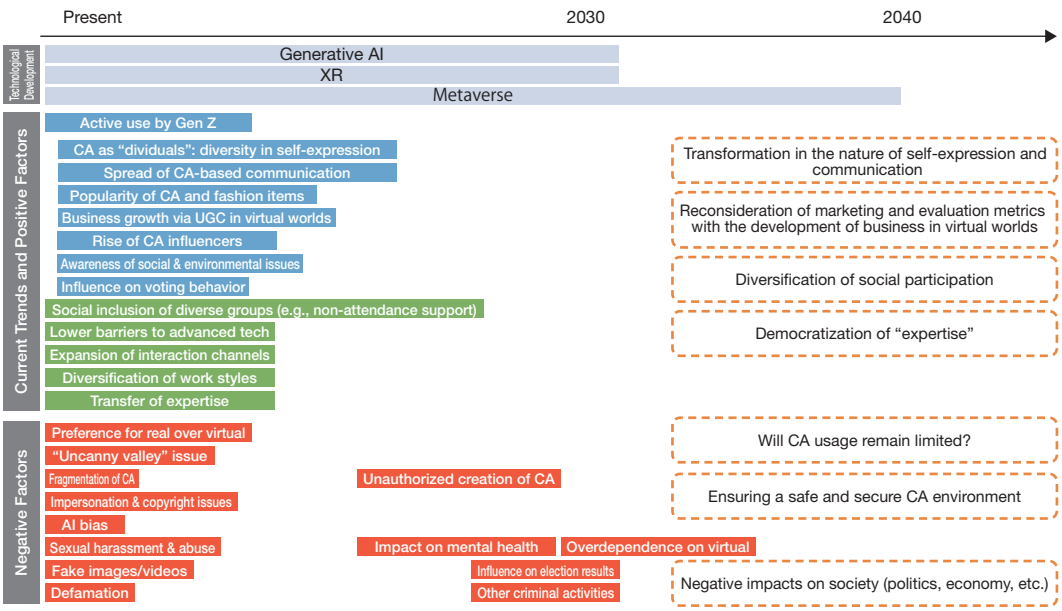


Figure 3.1 Positive and negative impacts of CA use and future projections for 2040

3.2. Evaluation of CA benefits in Japan and abroad

This section presents how people evaluate the potential social benefits of CAs. The survey data used are the same as those described in Chapter 2.

First, respondents were asked to rate future benefits on a 7-point scale. Figure 3.2 shows the percentage of respondents who selected "somewhat favorable" or higher. The most highly rated benefit was "People with physical limitations will be able to participate more actively in society through CAs" (66.7%), followed by "People will be able to experience places around the world without physical travel restrictions" (63.3%), and "People will be able to access interactive, high-quality educational content and training without geographical restrictions" (62.3%). These results indicate strong expectations for alleviating physical and distance-related constraints and for expanding opportunities for diverse experiences and education.

Next, the results were analyzed by user group (Figure 3.3). Overall, HMD users tended to give higher ratings than those who use only CAs, who in turn rated benefits higher than non-users. For the top three benefits mentioned above, HMD users and CA-only users showed little difference, suggesting that these

benefits are expected even without HMD use.

Finally, a breakdown by country (Figure 3.4) revealed that respondents in the United States gave the highest overall ratings, followed by South Korea and Germany. In contrast, evaluations in Japan were consistently lower than in other countries.

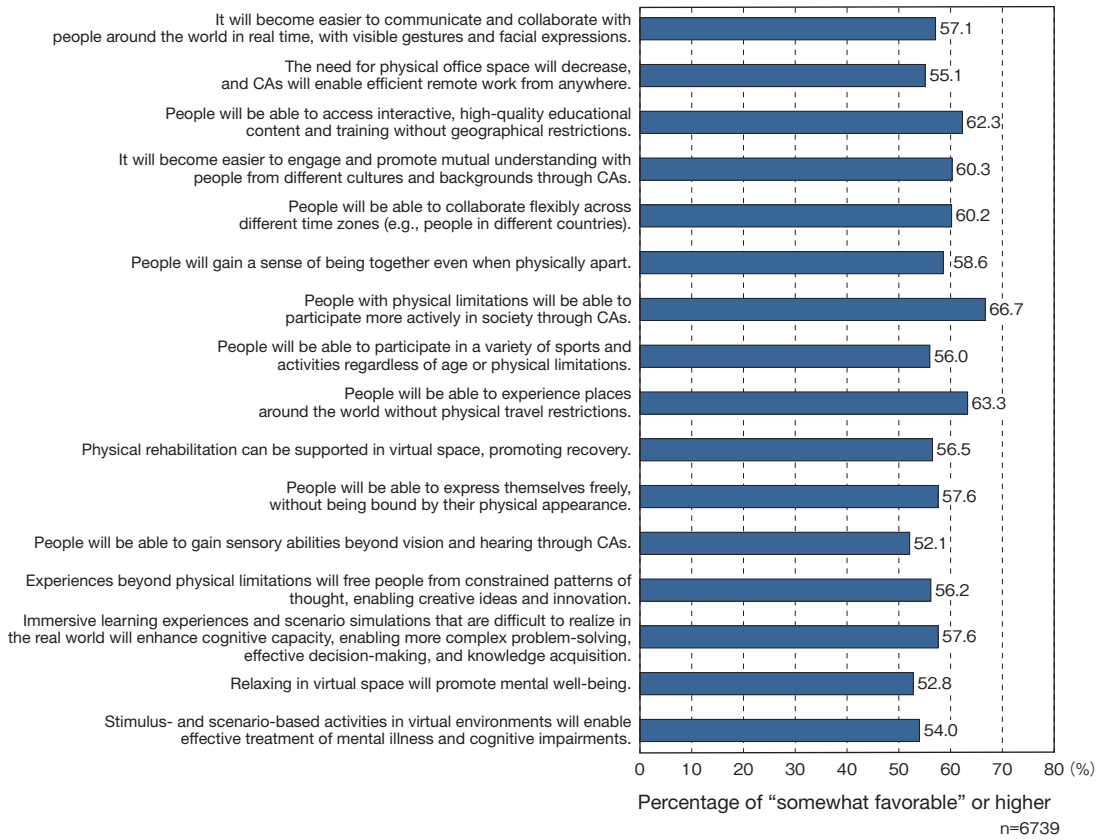


Figure 3.2 Evaluation of the expected future benefits of CAs (overall)

Figure 3.3 Evaluation of the expected future benefits of CAs (by CA user group)

Percentage of "somewhat favorable" or higher	CA and HMD users	CA only user	Neither	Total
It will become easier to communicate and collaborate with people around the world in real time, with visible gestures and facial expressions.	73.6%	66.9%	43.2%	57.1%
The need for physical office space will decrease, and CAs will enable efficient remote work from anywhere.	72.4%	61.4%	42.5%	55.1%
People will be able to access interactive, high-quality educational content and training without geographical restrictions.	73.6%	72.5%	51.1%	62.3%
It will become easier to engage and promote mutual understanding with people from different cultures and backgrounds through CAs.	74.4%	70.4%	47.6%	60.3%
People will be able to collaborate flexibly across different time zones (e.g., people in different countries).	73.7%	68.8%	48.5%	60.2%
People will gain a sense of being together even when physically apart.	74.3%	66.9%	45.9%	58.6%
People with physical limitations will be able to participate more actively in society through CAs.	76.9%	76.9%	56.0%	66.7%
People will be able to participate in a variety of sports and activities regardless of age or physical limitations.	72.6%	61.5%	44.2%	56.0%
People will be able to experience places around the world without physical travel restrictions.	73.8%	71.8%	53.4%	63.3%
Physical rehabilitation can be supported in virtual space, promoting recovery.	73.2%	61.9%	44.8%	56.5%
People will be able to express themselves freely, without being bound by their physical appearance.	72.6%	68.1%	44.2%	57.6%
People will be able to gain sensory abilities beyond vision and hearing through CAs.	71.8%	57.7%	38.6%	52.1%
Experiences beyond physical limitations will free people from constrained patterns of thought, enabling creative ideas and innovation.	73.5%	65.3%	42.3%	56.2%
Immersive learning experiences and scenario simulations that are difficult to realize in the real world will enhance cognitive capacity, enabling more complex problem-solving, effective decision-making, and knowledge acquisition.	73.5%	65.9%	44.7%	57.6%
Relaxing in virtual space will promote mental well-being.	72.7%	58.0%	39.5%	52.8%
Stimulus- and scenario-based activities in virtual environments will enable effective treatment of mental illness and cognitive impairments.	71.0%	60.3%	41.7%	54.0%

n=1776, 1672, 3291, 6739

Figure 3.4 Evaluation of the expected future benefits of CAs (by country)

Percentage of "somewhat favorable" or higher	Japan	South Korea	United States	Germany	Overall
It will become easier to communicate and collaborate with people around the world in real time, with visible gestures and facial expressions.	49.2%	57.0%	62.6%	59.5%	57.1%
The need for physical office space will decrease, and CAs will enable efficient remote work from anywhere.	47.3%	57.9%	60.4%	54.3%	55.1%
People will be able to access interactive, high-quality educational content and training without geographical restrictions.	51.6%	64.7%	67.4%	65.4%	62.3%
It will become easier to engage and promote mutual understanding with people from different cultures and backgrounds through CAs.	50.5%	61.9%	66.3%	62.3%	60.3%
People will be able to collaborate flexibly across different time zones (e.g., people in different countries).	51.7%	63.0%	64.6%	61.1%	60.2%
People will gain a sense of being together even when physically apart.	50.0%	63.3%	67.8%	52.8%	58.6%
People with physical limitations will be able to participate more actively in society through CAs.	55.3%	66.5%	72.8%	72.1%	66.7%
People will be able to participate in a variety of sports and activities regardless of age or physical limitations.	51.0%	60.1%	58.4%	54.0%	56.0%
People will be able to experience places around the world without physical travel restrictions.	54.7%	64.8%	69.8%	63.7%	63.3%
Physical rehabilitation can be supported in virtual space, promoting recovery.	51.9%	53.3%	60.6%	60.4%	56.5%
People will be able to express themselves freely, without being bound by their physical appearance.	52.8%	62.2%	60.9%	54.3%	57.6%
People will be able to gain sensory abilities beyond vision and hearing through CAs.	43.0%	52.5%	56.3%	56.5%	52.1%
Experiences beyond physical limitations will free people from constrained patterns of thought, enabling creative ideas and innovation.	46.1%	60.6%	62.7%	54.9%	56.2%
Immersive learning experiences and scenario simulations that are difficult to realize in the real world will enhance cognitive capacity, enabling more complex problem-solving, effective decision-making, and knowledge acquisition.	46.3%	61.7%	60.8%	61.4%	57.6%
Relaxing in virtual space will promote mental well-being.	47.7%	46.2%	61.3%	56.3%	52.8%
Stimulus- and scenario-based activities in virtual environments will enable effective treatment of mental illness and cognitive impairments.	48.2%	52.8%	58.3%	56.8%	54.0%

n=1654, 1750, 1697, 1638, 6739

3.3. Relationship between CA use and well-being

3.3.1. Overview of the relationship between CA use and well-being

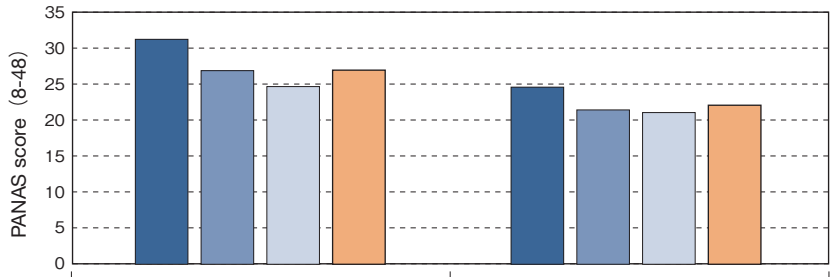
First, on the Positive and Negative Affect Schedule (PANAS), which measures emotional well-being,[50] both positive and negative affect scores tended to increase in the order of HMD users > CA users > non-users (Figure 3.5). In other words, HMD users experienced stronger positive emotions as well as stronger negative emotions.

Figure 3.6 presents the results of the measurement of the four factors of subjective well-being. For three of the four factors—"self-actualization and growth," "positivity and optimism," and "independence and self-reliance"—excluding "connection and gratitude," scores were highest among HMD users, followed

50. Maeno, R. (2013). *The Mechanism of Happiness: An Introduction to Practical Happiness Studies.* Kodansha.

by CA users, and lowest among non-users. This confirms the trend of HMD users reporting higher levels of well-being. For the factor "connection and gratitude," however, CA-only users scored the highest, while HMD users tended to score slightly lower. Nevertheless, HMD users still scored higher than non-users.

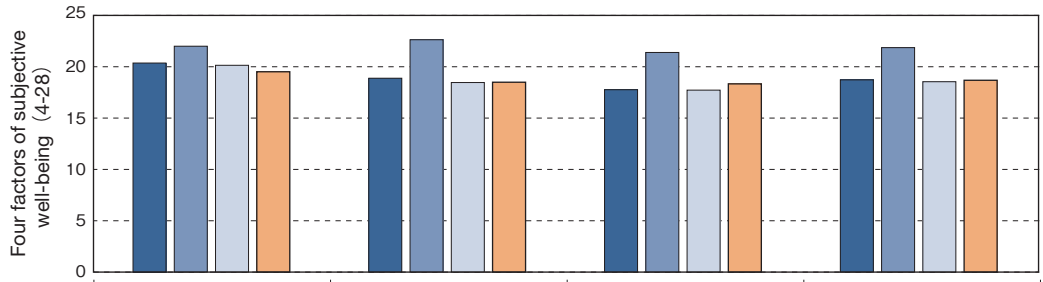
In addition, life satisfaction measured using Diener's Satisfaction with Life Scale (Figure 3.7) and the Cantril Ladder Scale (Figure 3.8) followed the same pattern: HMD users > CA-only users > non-users. Overall, although HMD users exhibited higher levels of happiness compared to non-users, caution is warranted when interpreting indicators such as "connection and gratitude" and negative affect.



	Positive	Negative
CA and HMD users	31.23	24.59
CA only user	26.88	21.43
Neither	24.67	21.06
Total	26.95	22.08

n=1776, 1672, 3291, 6739

Figure 3.5 Emotional well-being measured by PANAS (overall and by user type)



	Self-actualization and growth	Connection and gratitude	Positivity and optimism	Independence and my pace
CA and HMD users	20.37	18.89	17.77	18.73
CA only user	22.01	22.64	21.40	21.87
Neither	20.15	18.47	17.73	18.55
Total	19.52	18.50	18.34	18.69

n=1776, 1672, 3291, 6739

Figure 3.6 Four factors of subjective well-being (overall and by user type)

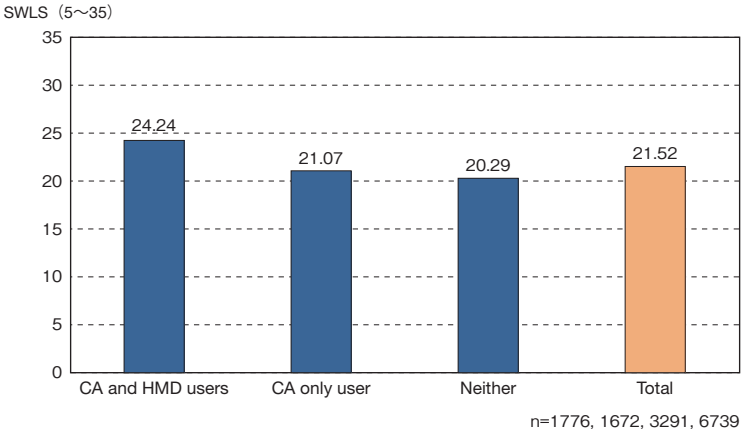


Figure 3.7 Satisfaction with life scale (by user type)

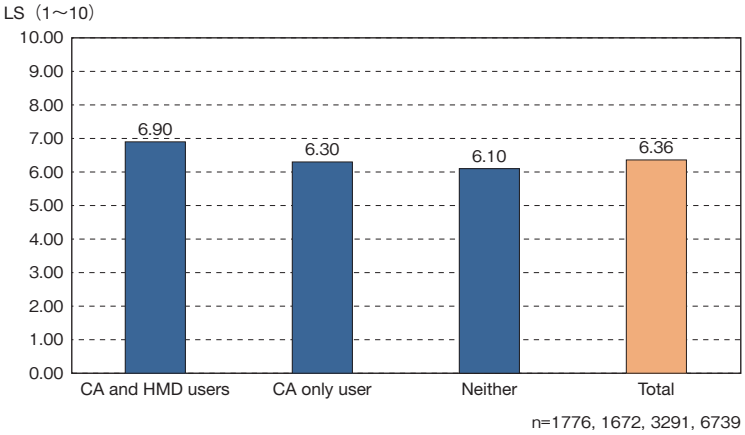


Figure 3.8 Life satisfaction (by user type)

3.3.2. Effects of CA and HMD use on well-being

To further examine the relationship between CA and HMD use and well-being, regression analyses were conducted using well-being indicators—including self-rated health—along with demographic attributes in addition to CA and HMD usage.[51]

The analysis revealed that CA users tended to experience higher levels of short-term positive emotions. Additionally, higher levels of happiness were observed in "self-actualization and growth," "connection and gratitude," and "positivity and optimism." By contrast, CA use alone was not strongly associated with increases in medium- or long-term life satisfaction, suggesting that other factors influence sustained well-being.

51. Yamaguchi, S. at el. (2024). Exploring the impact of cybernetic avatars and head-mounted displays on various aspects of well-being. *SSRN, 4982172.*
https://doi.org/10.2139/ssrn .4982172

Similarly, HMD use was linked to higher short-term positive affect. HMD users generally exhibited greater medium- and long-term life satisfaction and higher scores in "self-actualization and growth," "positivity and optimism," and "self-being and my pace." However, well-being related to "connection and gratitude" tended to be lower among HMD users, indicating that the immersive nature of HMDs may affect the maintenance of real-life relationships.

Cross-national comparisons revealed regional differences in these effects. In the United States and Germany, HMD use was associated with higher medium- to long-term well-being, whereas this association was weaker or absent in Japan and South Korea, possibly reflecting differences in technology acceptance or cultural context. For the "connection and gratitude" factor, users outside Japan generally scored lower, highlighting the challenge of balancing immersive technology use with real-world social interactions.

Overall, CA and HMD use appear to enhance well-being, particularly over the long term for HMD users. However, short-term physical strain or stress associated with HMDs may induce negative emotions, underscoring the need for technical improvements and better user experience. Social rules and guidelines should be established to manage the impact of immersive technology on interpersonal relationships, and promotion strategies should be adapted to each country's cultural and social context.

3.4. Anxiety about using CAs

When the percentage of respondents who answered "somewhat anxious" or higher regarding CA use was aggregated (Figure 3.9), the most frequently cited concern was "My data or account information will be stolen and used for unauthorized purchases or contracts" (64.8%), followed by "My body or privacy-related information will be stolen and misused" (60.9%) and "World data or profile information in the metaverse space will be tampered with" (57.6%). These results indicate a high level of concern regarding risks related to personal information and privacy.

In the usage group (Figure 3.10), most differences were minor, but some items showed slightly higher levels of anxiety among HMD users. In particular, concerns such as "Communication beyond time and space will become possible" and "Someone with a face or body similar to mine will have a different personality" were slightly more prevalent among HMD users.

Furthermore, the results by country (Figure 3.11) showed that anxiety levels tended to be higher in Germany and the United States, while they were relatively lower in Japan and South Korea. Although no extreme differences were observed by item, variations in cultural backgrounds and information security awareness may have influenced the results.

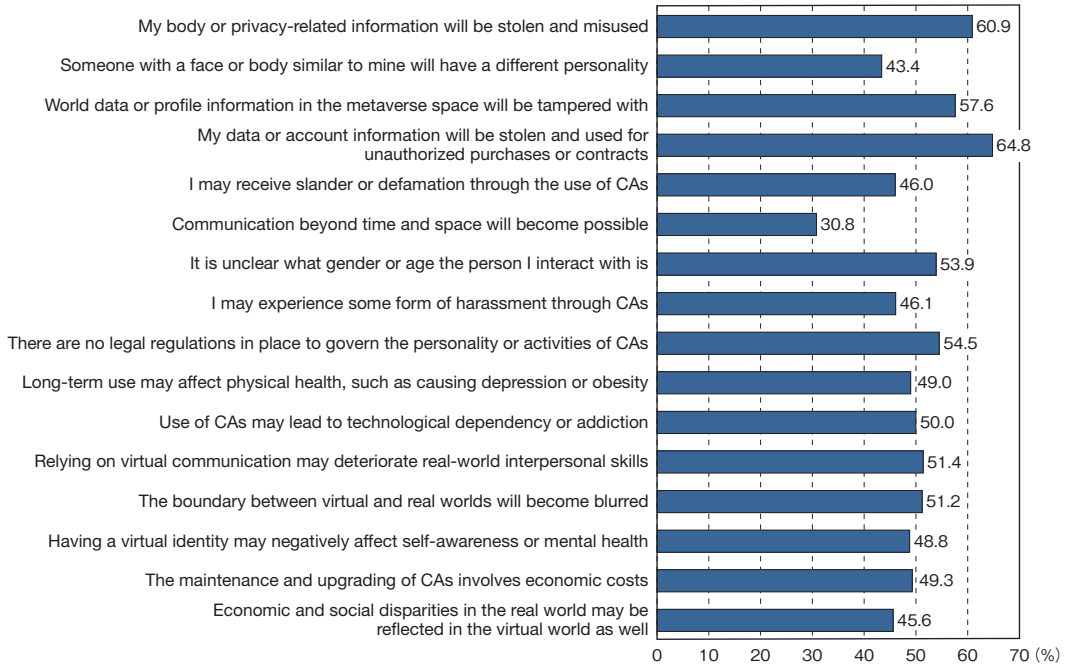


Figure 3.9 Anxiety about CA use (overall)

Figure 3.10 Anxiety about CA use (by user group)

Percentage of respondents who feel "somewhat anxious" or more	CA and HMD user	CA only user	Neither	Total
My body or privacy-related information will be stolen and misused	59.2%	64.5%	60.0%	60.9%
Someone with a face or body similar to mine will have a different personality	47.4%	40.1%	42.9%	43.4%
World data or profile information in the metaverse space will be tampered with	57.5%	60.3%	56.4%	57.6%
My data or account information will be stolen and used for unauthorized purchases or contracts	61.3%	70.9%	63.6%	64.8%
I may receive slander or defamation through the use of CAs	51.4%	46.9%	42.6%	46.0%
Communication beyond time and space will become possible	41.4%	25.5%	27.7%	30.8%
It is unclear what gender or age the person I interact with is	54.3%	57.1%	52.1%	53.9%
I may experience some form of harassment through CAs	50.8%	45.4%	43.8%	46.1%
There are no legal regulations in place to govern the personality or activities of CAs	54.1%	56.4%	53.9%	54.5%
Long-term use may affect physical health, such as causing depression or obesity	53.2%	50.7%	45.9%	49.0%
Use of CAs may lead to technological dependency or addiction	51.9%	53.1%	47.4%	50.0%
Relying on virtual communication may deteriorate real-world interpersonal skills	51.7%	52.5%	50.7%	51.4%
The boundary between virtual and real worlds will become blurred	52.4%	51.1%	50.6%	51.2%
Having a virtual identity may negatively affect self-awareness or mental health	51.2%	49.4%	47.1%	48.8%
The maintenance and upgrading of CAs involves economic costs	50.8%	47.3%	49.5%	49.3%
Economic and social disparities in the real world may be reflected in the virtual world as well	50.3%	46.0%	42.9%	45.6%

n=1776, 1672, 3291, 6739

Figure 3.11 Anxiety about CA use (by country)

Percentage of respondents who feel "somewhat anxious" or more	Japan	South Korea	United States	Germany	Overall
My body or privacy-related information will be stolen and misused	58.5%	62.2%	61.3%	61.5%	62.2%
Someone with a face or body similar to mine will have a different personality	38.5%	45.5%	46.4%	42.9%	45.5%
World data or profile information in the metaverse space will be tampered with	52.8%	57.4%	61.2%	59.1%	57.4%
My data or account information will be stolen and used for unauthorized purchases or contracts	61.1%	64.0%	68.2%	65.9%	64.0%
I may receive slander or defamation through the use of CAs	47.0%	52.3%	42.6%	41.8%	52.3%
Communication beyond time and space will become possible	26.9%	27.1%	34.7%	34.6%	27.1%
It is unclear what gender or age the person I interact with is	50.5%	49.4%	59.4%	56.5%	49.4%
I may experience some form of harassment through CAs	46.7%	42.3%	50.4%	45.0%	42.3%
There are no legal regulations in place to govern the personality or activities of CAs	50.5%	55.5%	53.5%	58.7%	55.5%
Long-term use may affect physical health, such as causing depression or obesity	43.8%	47.3%	52.9%	52.1%	47.3%
Use of CAs may lead to technological dependency or addiction	43.3%	49.0%	51.3%	56.4%	49.0%
Relying on virtual communication may deteriorate real-world interpersonal skills	40.0%	46.9%	62.5%	56.2%	46.9%
The boundary between virtual and real worlds will become blurred	41.1%	45.5%	58.0%	60.4%	45.5%
Having a virtual identity may negatively affect self-awareness or mental health	38.3%	46.1%	53.5%	57.3%	46.1%
The maintenance and upgrading of CAs involves economic costs	47.6%	49.5%	47.7%	52.4%	49.5%
Economic and social disparities in the real world may be reflected in the virtual world as well	41.0%	45.1%	48.5%	47.8%	45.1%

n=1654, 1750, 1697, 1638, 6739

3.5. Evaluation of negative social changes in Japan and abroad

This section presents how people evaluate the possible negative social changes that may result from widespread CA adoption.

First, when the percentage of respondents who answered "somewhat bad" or worse was tallied using a 7-point scale (Figure 3.12), more than 60% gave negative evaluations across many items. The most negatively evaluated item was "Misinformation will spread in virtual spaces" (68.5%), followed by "Increased online activity will raise the risk of personal information leaks and privacy violations" (67.9%) and "Negative effects on physical and eye health will occur" (66.7%). Notably, concerns over misinformation exceeded those regarding privacy. By contrast, only 46.2% negatively evaluated "Global interaction will dilute local cultures and identities," indicating that this item was perceived less negatively than the others.

In the CA user group (Figure 3.13), CA-only users gave the highest negative evaluations, followed by non-users and HMD users. This suggests that among users, CA-only users may be more concerned about future societal impacts than HMD users. Germany showed the highest level of negative evaluations, followed by the United States, South Korea, and Japan (Figure 3.14). While the United States had the highest positive evaluation (see Figure 3.4), Germany recorded high ratings for both positive and negative aspects. In contrast, Japan showed a more moderate stance, with relatively lower evaluations on both fronts.

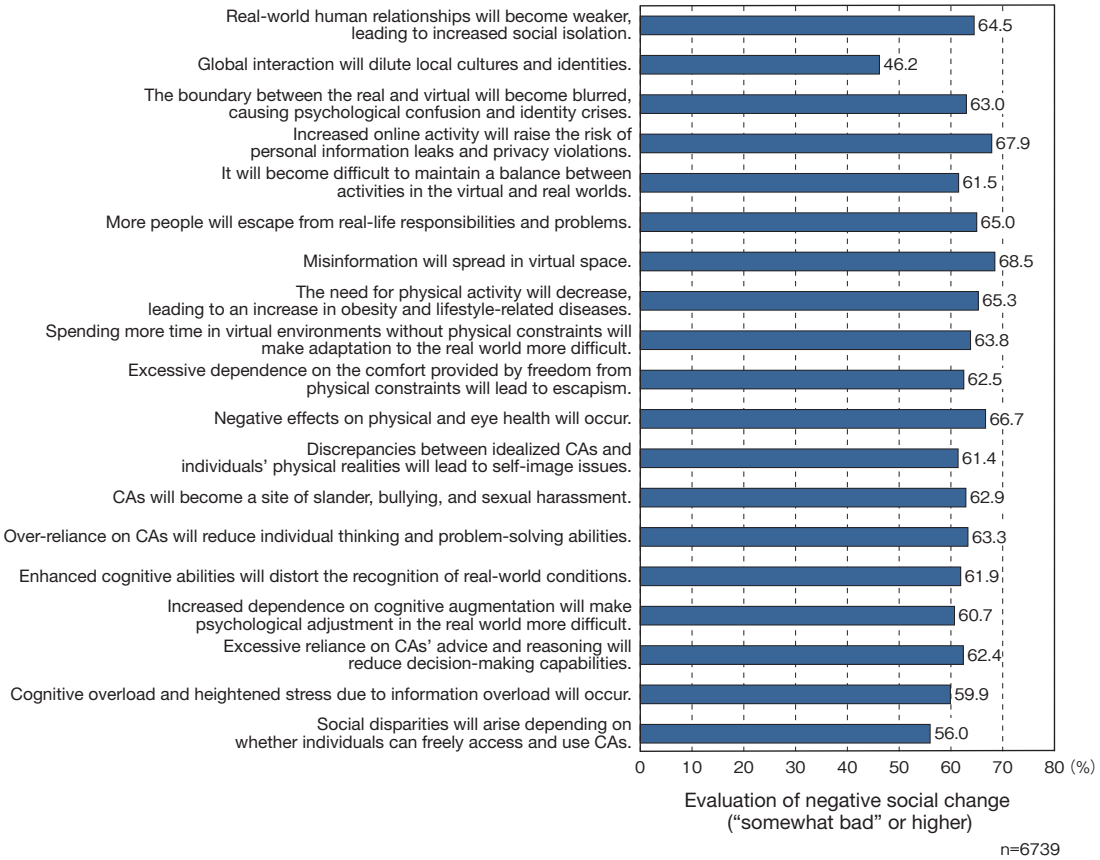


Figure 3.12 Evaluation of negative social change at home and abroad (overall)

Figure 3.13 Evaluation of negative social change at home and abroad (by user group)

Evaluation of negative social change ("somewhat bad" or higher)	CA and HMD user	CA only user	Neither	Total
Real-world human relationships will become weaker, leading to increased social isolation.	56.0%	70.2%	66.2%	64.5%
Global interaction will dilute local cultures and identities.	49.5%	45.1%	45.0%	46.2%
The boundary between the real and virtual will become blurred, causing psychological confusion and identity crises.	56.1%	67.2%	64.6%	63.0%
Increased online activity will raise the risk of personal information leaks and privacy violations.	61.3%	73.6%	68.5%	67.9%
It will become difficult to maintain a balance between activities in the virtual and real worlds.	54.4%	64.3%	63.9%	61.5%
More people will escape from real-life responsibilities and problems.	55.5%	69.6%	67.7%	65.0%
Misinformation will spread in virtual space.	59.6%	75.8%	69.6%	68.5%
The need for physical activity will decrease, leading to an increase in obesity and lifestyle-related diseases.	58.1%	70.9%	66.2%	65.3%
Spending more time in virtual environments without physical constraints will make adaptation to the real world more difficult.	55.9%	68.8%	65.6%	63.8%
Excessive dependence on the comfort provided by freedom from physical constraints will lead to escapism.	57.0%	66.9%	63.2%	62.5%
Negative effects on physical and eye health will occur.	59.1%	73.0%	67.5%	66.7%
Discrepancies between idealized CAs and one's physical reality will lead to self-image issues.	55.4%	66.1%	62.3%	61.4%
CAs will become a site of slander, bullying, and sexual harassment.	58.1%	67.5%	63.1%	62.9%
Over-reliance on CAs will reduce individual thinking and problem-solving abilities.	56.5%	66.2%	65.6%	63.3%
Enhanced cognitive abilities will distort the recognition of real-world conditions.	57.4%	64.4%	63.1%	61.9%
Increased dependence on cognitive augmentation will make psychological adjustment in the real world more difficult.	55.0%	64.3%	62.0%	60.7%
Excessive reliance on CAs' advice and reasoning will reduce decision-making capabilities.	56.4%	65.4%	64.0%	62.4%
Cognitive overload and heightened stress due to information overload will occur.	55.2%	61.9%	61.5%	59.9%
Social disparities will arise depending on whether individuals can freely access and use CAs.	53.8%	59.4%	55.4%	56.0%

n=1776, 1672, 3291, 6739

Figure 3.14 Evaluation of negative social change at home and abroad (by country)

Evaluation of negative social change ("somewhat bad" or higher)	Japan	South Korea	United States	Germany	Overall
Real-world human relationships will become weaker, leading to increased social isolation.	56.1%	60.6%	68.5%	72.8%	64.5%
Global interaction will dilute local cultures and identities.	40.4%	41.8%	51.1%	51.6%	46.2%
The boundary between the real and virtual will become blurred, causing psychological confusion and identity crises.	56.1%	59.5%	65.9%	70.8%	63.0%
Increased online activity will raise the risk of personal information leaks and privacy violations.	64.1%	67.3%	69.5%	70.6%	67.9%
It will become difficult to maintain a balance between activities in the virtual and real worlds.	57.8%	56.3%	63.3%	69.0%	61.5%
More people will escape from real-life responsibilities and problems.	59.1%	62.8%	62.3%	75.9%	65.0%
Misinformation will spread in virtual space.	66.3%	66.5%	67.9%	73.3%	68.5%
The need for physical activity will decrease, leading to an increase in obesity and lifestyle-related diseases.	58.6%	60.1%	69.7%	73.0%	65.3%
Spending more time in virtual environments without physical constraints will make adaptation to the real world more difficult.	58.0%	59.0%	67.4%	71.2%	63.8%
Excessive dependence on the comfort provided by freedom from physical constraints will lead to escapism.	57.3%	58.1%	62.9%	71.9%	62.5%
Negative effects on physical and eye health will occur.	65.1%	63.4%	68.1%	70.3%	66.7%
Discrepancies between idealized CAs and one's physical reality will lead to self-image issues.	53.7%	56.8%	66.2%	69.2%	61.4%
CAs will become a site of slander, bullying, and sexual harassment.	61.9%	59.9%	64.6%	65.4%	62.9%
Over-reliance on CAs will reduce individual thinking and problem-solving abilities.	58.2%	60.2%	66.5%	68.7%	63.3%
Enhanced cognitive abilities will distort the recognition of real-world conditions.	55.0%	58.8%	65.7%	68.1%	61.9%
Increased dependence on cognitive augmentation will make psychological adjustment in the real world more difficult.	57.0%	55.3%	64.8%	66.1%	60.7%
Excessive reliance on CAs' advice and reasoning will reduce decision-making capabilities.	58.3%	58.9%	64.9%	67.4%	62.4%
Cognitive overload and heightened stress due to information overload will occur.	57.3%	55.4%	61.1%	66.2%	59.9%
Social disparities will arise depending on whether individuals can freely access and use CAs.	52.4%	54.2%	57.5%	60.1%	56.0%

n=1654, 1750, 1697, 1638, 6739

3.6. Determinants of positive and negative evaluations of CA in Japan and abroad

In this section, we conducted regression analyses using variables such as CA and HMD usage status, demographic characteristics, and country affiliation to explore the factors influencing how people evaluate CA-related social changes.

The results show that HMD users tended to give higher positive and lower negative evaluations of CAs' future potential. CA-only users also expressed high positive evaluations, but their negative evaluations were not as low as those of HMD users.

In addition, communication skills, particularly expressiveness and attentiveness, were associated with both types of evaluation; individuals with stronger relationship-building skills were more likely to view CAs positively and less likely to view them negatively.

Regarding demographics, older respondents tended to give lower positive and higher negative evaluations than younger respondents. Women were also more likely to have a negative view of CAs' future. In contrast, residents of large cities and those with higher annual household incomes tended to have more favorable views of CAs' potential.

Looking at trends by country, Japan, South Korea, and the United States showed relatively high positive evaluations, whereas Germany had the highest negative ratings. This may reflect Germany's more cautious stance toward technological risk.

Based on these findings, increasing CAs' social acceptance requires presenting clear benefits to those without prior usage experience and reducing anxiety through privacy protection and other safeguards.

4

Use of CAs in companies (international comparison)

4.1. Examples of CA applications in companies

Companies use CAs to create new value across diverse fields, including strengthening telework systems, onboarding new employees, hosting internal events, and providing remote customer service. This section provides a comprehensive overview of domestic and international examples from various perspectives, such as virtual offices, internal communication, in-house events, recruitment and training, on-site management, and guidance.

4.1.1. Virtual office and internal communication

Company Name (Country)	Summary
HIKKY (Japan)	From its founding, the company adopted a remote-first work style, with employees operating under virtual names and CAs. Integrating VRChat and Slack fostered an egalitarian workplace where gender and age hold no weight in discussions. This setup improved self-esteem and encouraged younger staff to speak up, but the absence of spontaneous, casual conversation—common in physical settings—remains a challenge.
DENSO (Japan)	In response to the growth of remote work, a virtual office was launched. Morning and evening meetings are held in virtual spaces to facilitate cross-site communication. Familiarity with VR also led to proposals in advanced fields.
Sapporo Breweries (Japan)	The office tool “oVice” was introduced to facilitate informal chats during remote work. Employees log in to the virtual office, allowing more casual interactions than video conferencing.
Zigbang (Korea)	The company built a metaverse platform, “Soma,” where approximately 1,000 employees work daily in a virtual office. Realism is emphasized in CA movement and voice interactions, enhancing communication efficiency and supporting ESG goals globally.

4.1.2. Organizing internal events

Company Name (Country)	Summary
Ricoh (Japan)	Held a large-scale in-house event using “oVice.” The layout, including chair placement, mimicked a real venue to foster unity and promote spontaneous interaction.
Dai Nippon Printing (Japan)	Used XR CLOUD to hold the “Future Creation Meeting 2024.” As part of its 150th anniversary efforts, a virtual space replicating the headquarters and AI CAs were used to generate new value.

4.1.3. Recruitment activities and new graduate engagement

Company Name (Country)	Summary
JTB Data Service (Japan)	In October 2024, a metaverse job fair was held for job seekers with disabilities. About 300 participants used CAs to lower the barrier of showing their faces. Through chats and document viewing, the event yielded 60 job consultations.
Sanei Hytechs (Japan)	Built a metaverse space on their platform to introduce the company to students, featuring a CA dress-up experience. It also showcases VRM CA technology.
Persol Cross Technology (Japan)	Created a virtual office for new hires in a metaverse. Business etiquette workshops and gatherings were held to reduce pre-employment anxiety, with some training conducted online for efficiency.
IKEA (Netherlands)	Reproduced a virtual store in Roblox and launched an initiative to hire “in-game employees” with hourly pay. This garnered attention as a way to discover next-generation talent and propose new work models.

4.1.4. Employee training (general and technical training)

Company Name (Country)	Summary
TOPPAN Group (Japan)	Provided around 500 new employees with VR headsets. Factory tours and lectures were replaced with hands-on learning in the metaverse, improving learning outcomes while enhancing peer interaction.
Japan Post Insurance (Japan)	Introduced corporate sales role-playing in a metaverse. Simulated interactions are expected to enhance proposal skills and responsiveness.
Accenture (Japan)	Deployed over 60,000 VR headsets globally and conducts new hire onboarding in “One Accenture Park” in a metaverse. The system emphasizes a sense of presence, even remotely, allowing for document sharing and whiteboard collaboration.
Walmart (USA)	Uses VR-based in-store training to help employees respond swiftly to situations like customer surges and complaints. This has significantly shortened training times and improved skill assessment.
Bank of America (USA)	Conducts VR scenario-based training in interpersonal skills (e.g., complaint handling, need elicitation). 97% of employees reported increased confidence, and the company plans to scale it to 200,000 employees.

Company Name (Country)	Summary
Vodafone (UK)	Built a virtual replica of real venues for company event speech practice. Employees improve presentation skills across scenarios (e.g., press conferences), and receive feedback. Managers can track progress and return on investment (ROI).
Delta Air Lines (USA)	Introduced VR de-icing training for aircraft technicians, reducing costs for expensive materials and travel. Enables realistic, repetitive training.

4.1.5. Site management and internal guidance

Company Name (Country)	Summary
Chuo Fukken Consultants (Japan)	Developed "CFK Metaverse," a metaverse consultation system utilizing BIM/CIM models to streamline civil engineering and construction project coordination.
Daikin Industries (Japan)	Conducts training for air conditioner installation and repair in a 3D metaverse, simulating cases difficult to experience on-site. Instructors remotely evaluate operations.
Taisei (Japan)	Developed a system to remotely control quadruped robots for construction site patrol using VR and omnidirectional cameras to improve safety and efficiency.
Zensei Pharmaceutical (Japan)	Introduced the guide robot "temi" to automate factory tour explanations. English support is available, significantly reducing the time required from staff.

4.1.6. Summary

Based on these examples, the main purposes of adopting CAs and metaverse technologies in companies include the following:

- Remote work and work-style reform: By leveraging VR offices and virtual names, companies can create flexible working environments that transcend location and employee attributes, encourage communication, and reduce employee turnover.
- Efficient training and skill development: Virtual environments enable repeated practice of scenarios that are difficult to replicate through on-the-job training (e.g., customer complaints and equipment issues). Major companies have observed improved learning outcomes while reducing costs and training times.
- Community engagement creation: Virtual event spaces and casual gatherings promote informal conversation and spontaneous interaction, helping build a shared sense of belonging across physical worksites.
- Remote customer service and robot utilization: CA robots and virtual staff can handle customer service and factory tours, ease labor shortages, and enable multilingual support. This not only lowers operational costs but also facilitates new types of customer experience.
- Stronger recruitment and onboarding support: Virtual job fairs and onboarding events in metaverse environments offer equitable opportunities for job seekers with physical or geographic constraints, reduce early turnover, and enhance understanding of the company.

Overall, CAs not only enhance corporate productivity and efficiency but are also gaining traction as a foundation for new ways of working, learning, and engaging customers in a remote-first era. Successful cases suggest that clearly defined purposes and applications, along with organization-wide rule setting and digital literacy training, are essential. The use of CAs is expected to expand across a wide range of industries and business domains.

4.2. Summary of questionnaire survey

This chapter presents the results of a survey conducted in Japan, South Korea, the United States, and Germany to assess the current usage and market size of CAs. The survey was conducted online in November 2024 and included questions on the usage status and frequency of CAs in corporate settings, business-related evaluations and concerns, and perceived investment value.

The survey targeted individuals aged 20–69 who were registered with internet research companies in each country, and the sample allocation was adjusted to reflect company workforce size. The final number of valid responses was 1,000 each for Japan, South Korea, the United States, and Germany (Figure 4.1).

Figure 4.1 Sample size for each country

Allocation	Japan	South Korea	United States	Germany	Overall
Number of employees: 1 to 9	250	250	250	250	1000
Number of employees: 10 to 49	250	250	250	250	1000
Number of employees: 50 to 249	250	250	250	250	1000
Number of employees: 250 or more	250	250	250	250	1000
Overall	1000	1000	1000	1000	4000

[Areas of CA application]

In this survey, the following sectors were predefined as anticipated areas of CA application, and responses were collected accordingly:

- Internal communication (e.g., online meetings, video calls)
- External communication (e.g., online meetings, video calls)
- Host or facilitate events (e.g., virtual events, exhibitions, seminars)
- Customer support (e.g., responding to inquiries and troubleshooting)
- Education (e.g., internal training, onboarding training)
- E-commerce and shopping (e.g., selling and promoting products and services in virtual stores)
- Enhancing customer satisfaction (e.g., employee CAs providing personalized services and experiences)
- Medical and healthcare (e.g., employee counseling using avatars)
- Disaster preparedness (e.g., training through CAs for events such as earthquakes or fires)

4.3. CA use in companies

This section presents data on the usage rates, usage scenarios, intent to use CAs, latent demand, and links to economic security regarding CAs in corporate settings. First, companies were asked whether they had used any form of CAs in their business operations. The percentages of companies that answered affirmatively were aggregated by company size (Figure 4.2) and country (Figure 4.3). The results show that approximately 40% of the companies reported using CAs in some form in their businesses (Figure 4.2).

By company size, medium-sized firms with 50–249 employees had the highest usage rate at 50.3%, followed by large companies with 250 or more employees at 46.8%. As company size decreased below this range, the usage rate of CAs tended to decline.

By country, approximately 60% of companies in the United States reported using CAs, followed by Germany at 55.5%. In contrast, South Korea stood at around 40%, and Japan was notably low at 8.7%, suggesting that the adoption of CAs in business settings was less advanced in the two Asian countries than in their Western counterparts.

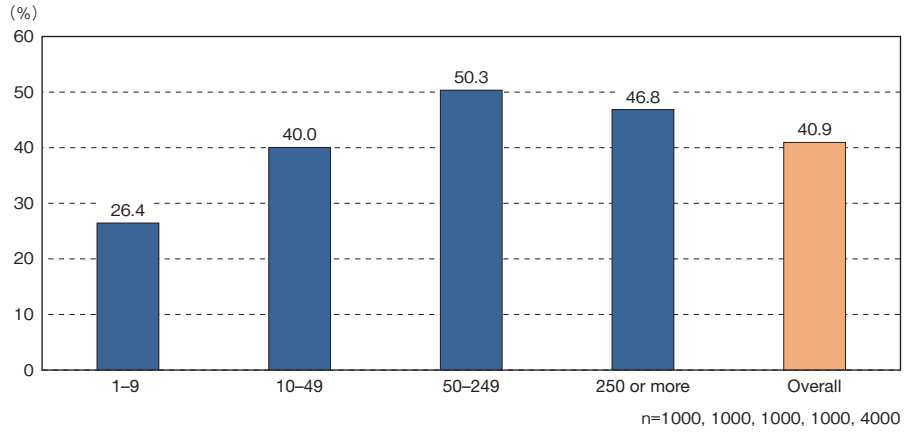


Figure 4.2 CA usage rates in companies (by company size + overall)

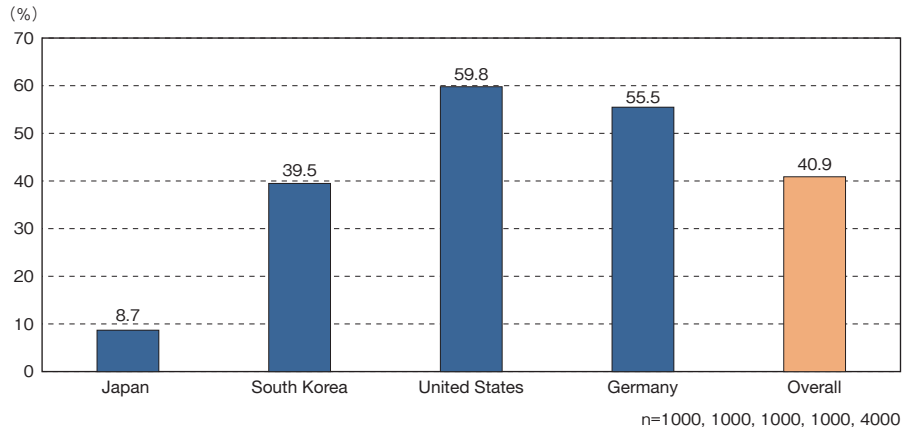


Figure 4.3 CA usage rates in companies (by country + overall)

When asked about specific use cases, the most common response was “Internal communication (e.g., online meetings, video calls)” at 22.2%, followed by “External communication (e.g., online meetings, video calls)” at 15.2%, and “Internal training and education” at 13.0% (Figure 4.4). These findings indicate that CA usage is concentrated in internal operations, especially communication and employee training, whereas its use in customer-facing activities, such as promotion and service provision, remains relatively limited.

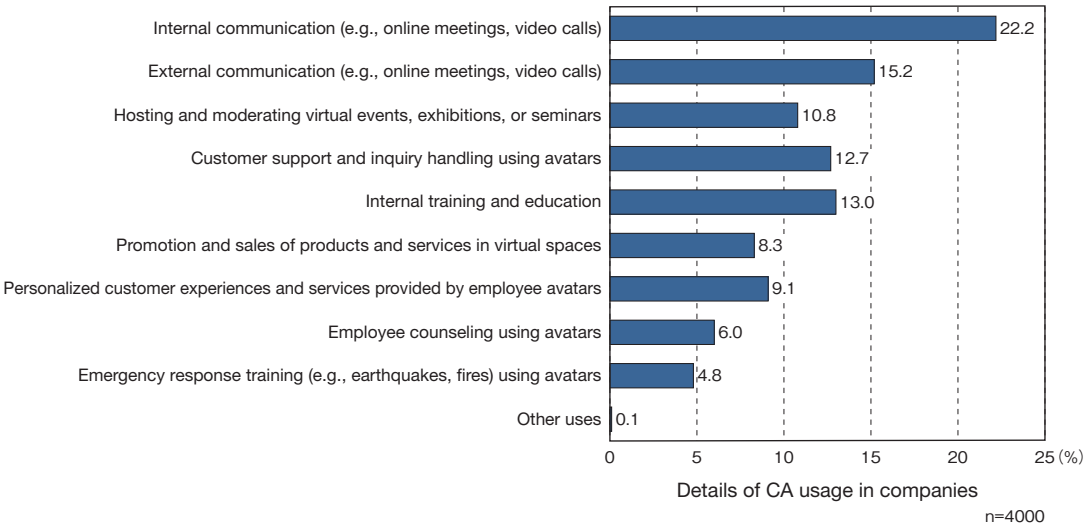


Figure 4.4 Details of CA usage in companies (overall)

Respondents who reported using CAs in their work were then asked about the frequency of CA usage. On average, CAs were used 9.65 days per month (Figure 4.5), roughly once every three days.

The highest frequency was observed in companies with 50–249 employees (11.22 days), whereas companies with 10–49 employees reported the lowest frequency (7.99 days). By country, the United States showed the highest frequency at 12.36 days per month—about 1.5 times that of South Korea (8.37 days) and more than twice that of Japan (6.09 days)—indicating a more advanced level of adoption (Figure 4.6).

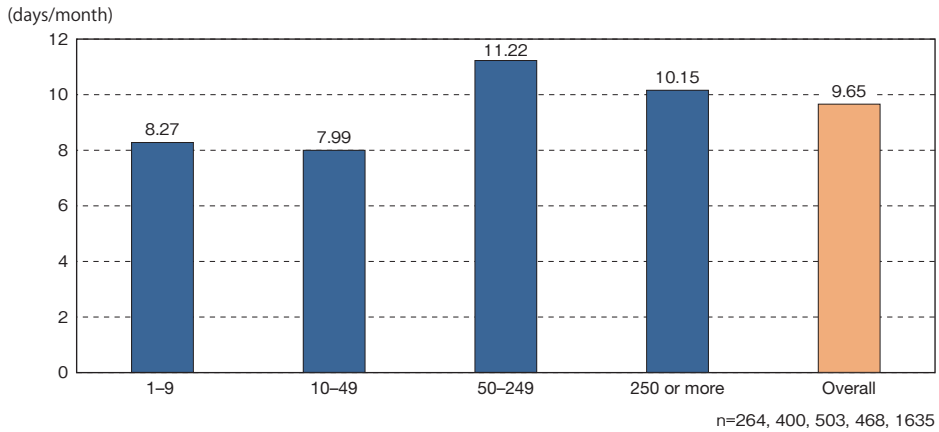


Figure 4.5 Monthly average number of days CAs are used (by company size + overall)

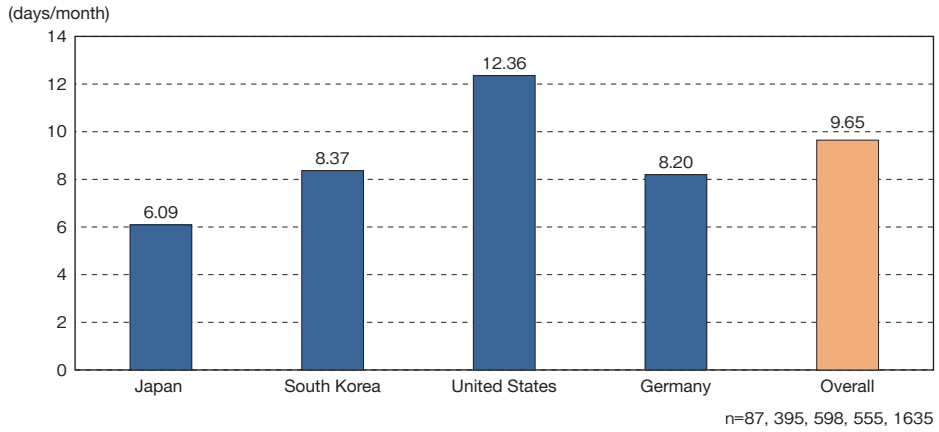


Figure 4.6 Monthly average number of days CAs are used (by country + overall)

When usage frequency is broken down by specific purpose, the highest average number of days was for "Personalized customer experiences and services provided by employee avatars" (8.94 days), followed closely by "Customer support and inquiry handling using avatars" (8.92 days), and "Promotion and sales of products and services in virtual spaces" (8.36 days) (Figure 4.7). These results indicate that CA use involving direct customer contact is more frequent than use involving internal and external communication.

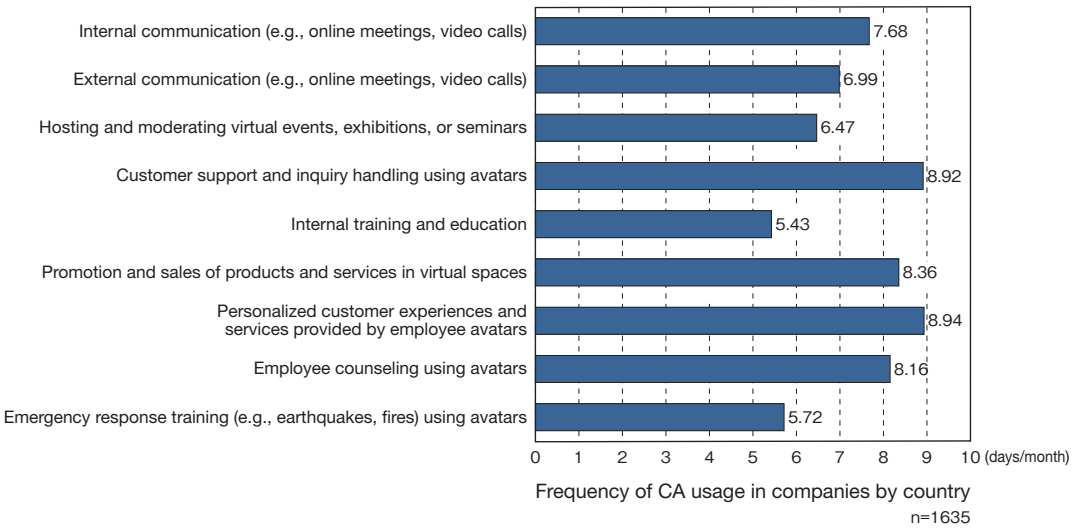
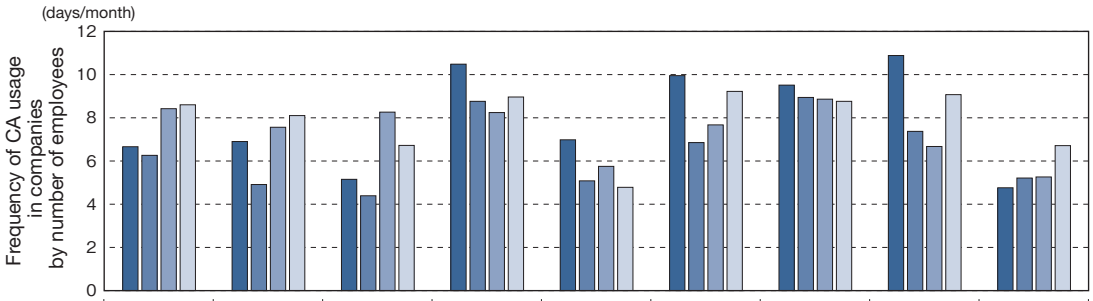


Figure 4.7 Monthly average number of days by CA usage type (overall)

Further analysis was conducted according to company size (Figure 4.8) and country (Figure 4.9). Internal and external communication–related CA use tended to increase with company size. In contrast, customer support, sales/promotions, and employee counseling were used more frequently by companies with fewer than 10 employees (Figure 4.8).

The United States reported the highest number of usage days across nearly all types of CA use. In particular, CA use related to providing products and services, such as "Promotion and sales of products and ser-

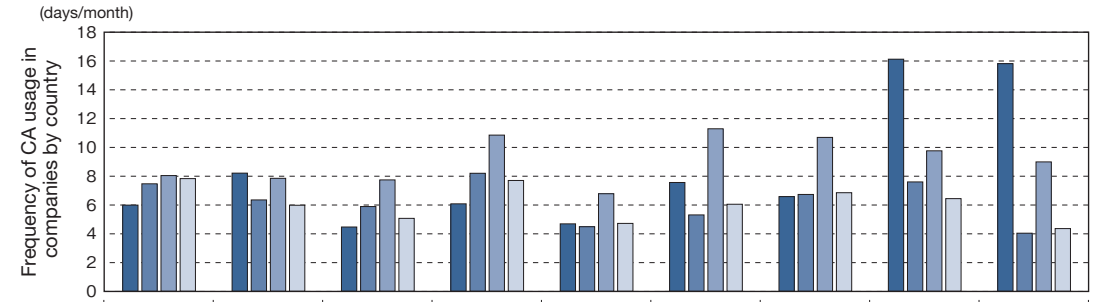
vices in virtual spaces" and "Personalized customer experiences and services provided by employee avatars," was notably frequent. In contrast, Japan showed exceptionally high usage in "Employee counseling using CAs" and "Emergency response training (e.g., earthquakes, fires) using avatars," each exceeding 15 days per month (Figure 4.9). These findings suggest that CAs are more commonly used for internal support in Japan and for customer-facing interactions in the United States.



	Internal communication (e.g., online meetings, video calls)	External communication (e.g., online meetings, video calls)	Hosting and moderating virtual events, exhibitions, or seminars	Customer support and inquiry handling using avatars	Internal training and education	Promotion and sales of products and services in virtual spaces	Personalized customer experiences and services provided by employee avatars	Employee counseling using avatars	Emergency response training (e.g., earthquakes, fires) using avatars
1–9	6.66	6.90	5.15	10.48	6.98	9.95	9.51	10.88	4.76
10–49	6.26	4.91	4.39	8.76	5.08	6.85	8.94	7.37	5.21
50–249	8.42	7.56	8.26	8.24	5.75	7.67	8.86	6.67	5.26
250 or more	8.60	8.10	6.72	8.96	4.78	9.22	8.76	9.07	6.71

n=886, 607, 432, 509, 520, 330, 363, 241, 193

Figure 4.8 Monthly average number of days by CA usage type (by company size)



	Internal communication (e.g., online meetings, video calls)	External communication (e.g., online meetings, video calls)	Hosting and moderating virtual events, exhibitions, or seminars	Customer support and inquiry handling using avatars	Internal training and education	Promotion and sales of products and services in virtual spaces	Personalized customer experiences and services provided by employee avatars	Employee counseling using avatars	Emergency response training (e.g., earthquakes, fires) using avatars
Japan	5.98	8.20	4.46	6.07	4.68	7.55	6.57	16.11	15.80
South Korea	7.46	6.34	5.88	8.19	4.48	5.30	6.72	7.59	4.03
United States	8.03	7.84	7.73	10.84	6.77	11.28	10.68	9.75	8.98
Germany	7.82	5.97	5.06	7.69	4.71	6.04	6.84	6.43	4.35

n=886, 607, 432, 509, 520, 330, 363, 241, 193

Figure 4.9 Monthly average number of days by CA usage type (by country)

4.4. Effects of CA use in companies

Respondents who had used CAs for work were asked to evaluate their effectiveness on a 7-point scale. Those who rated any usage method as "somewhat effective" or higher were counted. Overall, 75.8% of respondents reported that CAs were effective in at least one area of use (Figure 4.10), indicating that more than three-quarters of companies using CAs recognized some degree of effectiveness.

The proportion was highest among companies with 50–249 employees (81.5%) and those with 250 or more employees (79.7%), while the smallest companies (1–9 employees) showed a lower rate of 67.0% (Figure 4.10). These results suggest that companies above a certain size are more likely to perceive the tangible benefits of using CAs.

By country, South Korea had the highest rate of positive evaluations (84.1%), followed by the United States (81.6%). In contrast, Germany (66.3%) and Japan (59.8%) showed lower levels of perceived effectiveness (Figure 4.11). These results highlight notable cross-national differences in the perceived value of CAs, with Japan showing a marked tendency to underestimate their usefulness.

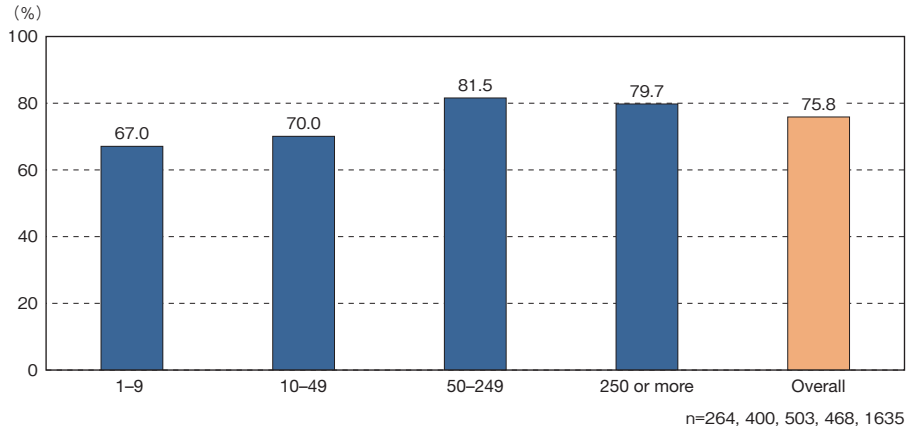


Figure 4.10 Percentage of respondents who perceived CA use as effective (by company size and overall)

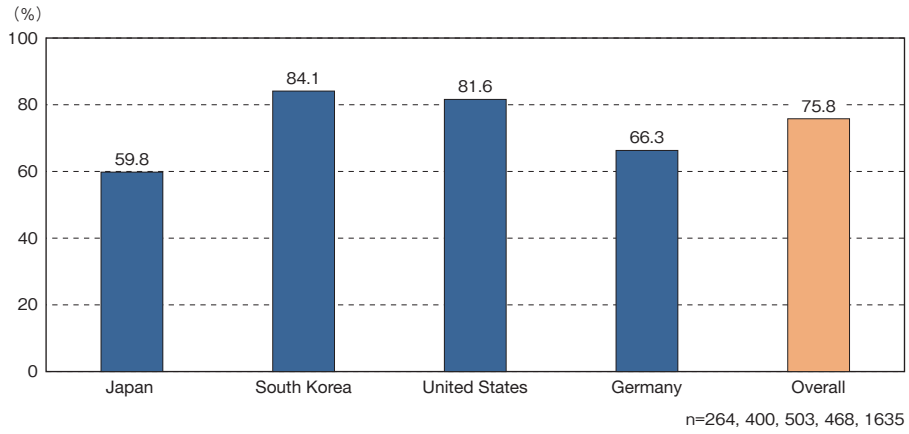


Figure 4.11 Percentage of respondents who perceived CA use as effective (by country and overall)

When looking at effectiveness by specific use case, the most highly rated was "personalized customer experiences and services provided by employee avatars" (82.6%), followed by "internal training and education" (81.5%) and "Promotion and sales of products and services in virtual spaces" (81.2%) (Figure 4.12). Except for in-house training, which had relatively low usage rates (see Figure 4.4), CA use involving direct customer interactions was often perceived as especially effective. In contrast, internal and external communications, despite high usage rates, had lower relative ratings, with approximately 70% of users perceiving them as effective.

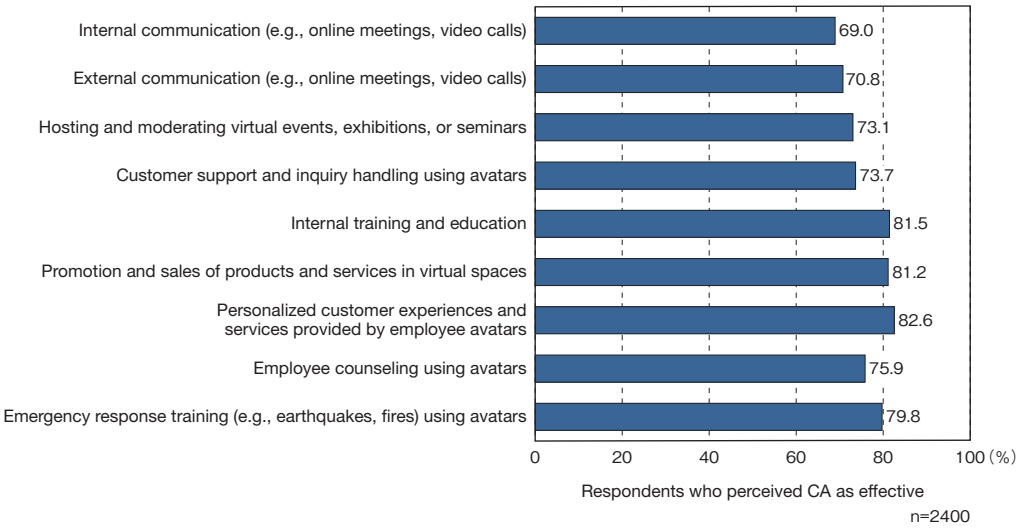
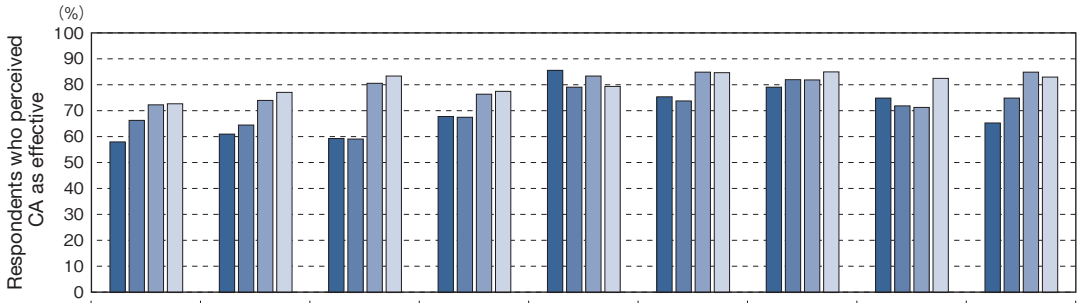


Figure 4.12 Perceived effectiveness by method of CA use (overall)

Effectiveness ratings generally increased with company size, particularly for communication-related use cases (Figure 4.13). In internal and external communication, the gap in perceived effectiveness exceeded 10 percentage points depending on company size. Meanwhile, for use cases such as "internal training and education," "personalized customer experiences and services provided by employee avatars," and "employee counseling using avatars," smaller companies tended to report comparable or even higher effectiveness. This suggests that for small businesses, non-communication uses of CAs may be particularly valuable.

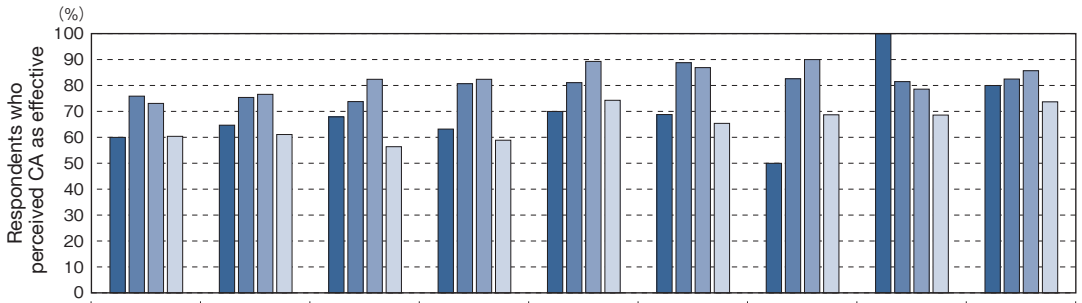
South Korea and the United States generally reported higher effectiveness across most use cases (Figure 4.14). One notable exception was "employee counseling using avatars," which received a 100% effectiveness rating in Japan. This indicates that in the Japanese context, CAs may be particularly well received when used for internal care and employee mental health support.



	Internal communication (e.g., online meetings, video calls)	External communication (e.g., online meetings, video calls)	Hosting and moderating virtual events, exhibitions, or seminars	Customer support and inquiry handling using avatars	Internal training and education	Promotion and sales of products and services in virtual spaces	Personalized customer experiences and services provided by employee avatars	Employee counseling using avatars	Emergency response training (e.g., earthquakes, fires) using avatars
1–9	58.1%	61.1%	59.4%	67.9%	85.7%	75.5%	79.2%	75.0%	65.4%
10–49	66.4%	64.6%	59.2%	67.6%	79.2%	73.9%	82.1%	72.0%	75.0%
50–249	72.4%	74.1%	80.7%	76.5%	83.5%	85.0%	82.0%	71.4%	85.0%
250 or more	72.8%	77.2%	83.5%	77.6%	79.5%	84.8%	85.1%	82.6%	83.1%

n=886, 607, 432, 509, 520, 330, 363, 241, 193

Figure 4.13 Perceived effectiveness by method of CA use (by company size)



	Internal communication (e.g., online meetings, video calls)	External communication (e.g., online meetings, video calls)	Hosting and moderating virtual events, exhibitions, or seminars	Customer support and inquiry handling using avatars	Internal training and education	Promotion and sales of products and services in virtual spaces	Personalized customer experiences and services provided by employee avatars	Employee counseling using avatars	Emergency response training (e.g., earthquakes, fires) using avatars
Japan	60.0%	64.7%	67.9%	63.2%	70.0%	68.8%	50.0%	100.0%	80.0%
South Korea	75.9%	75.4%	73.8%	80.7%	81.1%	88.8%	82.6%	81.5%	82.5%
United States	73.1%	76.6%	82.4%	82.4%	89.3%	86.9%	90.0%	78.6%	85.7%
Germany	60.4%	61.1%	56.4%	58.9%	74.3%	65.4%	68.7%	68.6%	73.7%

n=886, 607, 432, 509, 520, 330, 363, 241, 193

Figure 4.14 Perceived effectiveness by method of CA use (by country)

4.5. Reasons for not using CAs in companies

A survey was conducted among those who had not used CAs regarding their current status of consideration within their organizations. The most common response was "Not considering using and have no plans to use in the future" (62.5%), followed by "Not considering using, but may use in the future" (18.8%), and "Don't know" (12.5%) (Figure 4.15). In companies that are not currently using CAs, more than 80% are not considering their use.

Larger companies show a more positive outlook on CA adoption (Figure 4.15). The group with the highest percentage of "Not considering using and have no plans to use in the future" was companies with 1–9 employees (70.8%), with nearly 90% not considering adoption at all.

By country, the United States showed the most positive attitude toward future CA use, with only 47.6% stating "Not considering using and have no plans to use in the future." Germany also demonstrated a relatively positive stance. In contrast, in Japan, 75.4% responded "Not considering using and have no plans to use in the future," and South Korea also appeared less inclined toward adoption than the two Western countries (Figure 4.16). These results indicate that not only is the usage rate higher in Western countries, but among non-user companies, consideration for adoption is also more active.

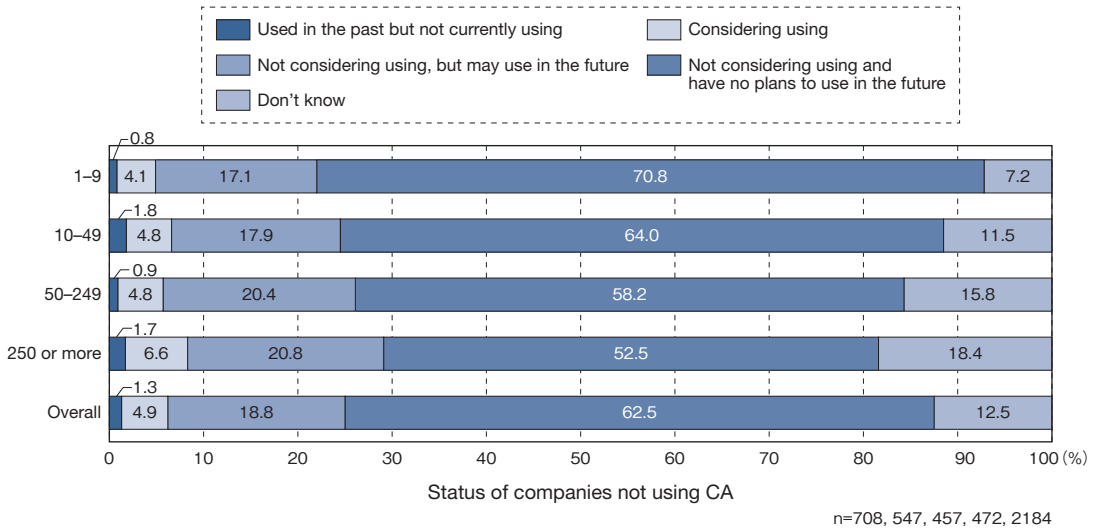


Figure 4.15 Companies not using CA (by company size)

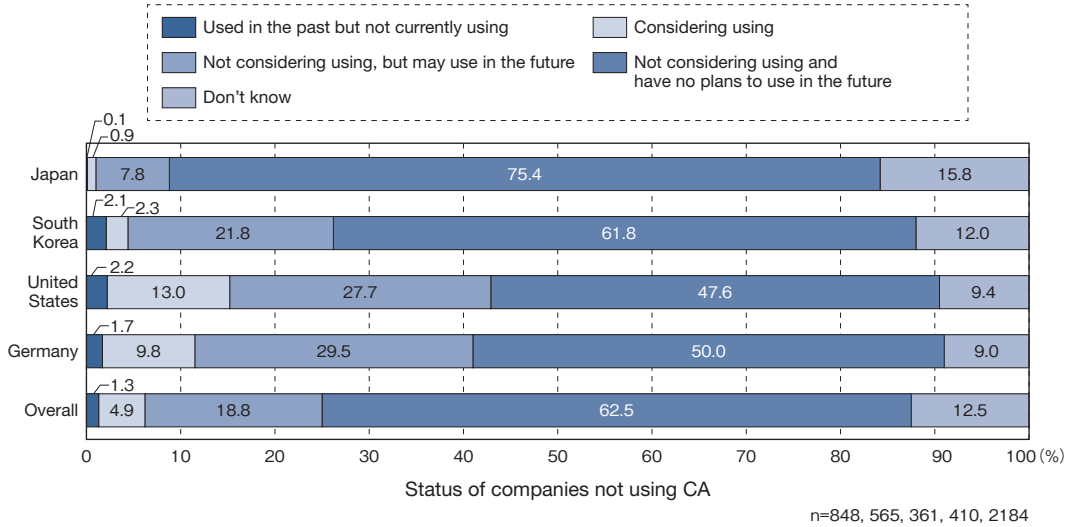


Figure 4.16 Companies not using CA (by country)

When asked why their company did not use CAs, the most common response was "I feel it is not necessary for our business" (62.0%), with all other reasons at or below 10% (Figure 4.17).

By company size, around 60% in all categories cited "I feel it is not necessary for our business," with smaller companies especially selecting this reason. In contrast, "Management policies and strategies for avatar use have not been clearly defined" and "It is difficult to measure the outcomes and return on investment from using avatars" were more often cited by larger companies (Figure 4.18). While lack of necessity was the main reason for postponement, some large firms cited strategic and cost-effectiveness concerns.

By country, "I feel it is not necessary for our business" was the dominant reason across all countries, particularly in the two Asian countries (Figure 4.19). In Japan, the second most common responses were "I don't know how to use it appropriately" (15.7%) and "No particular reason" (10.1%), suggesting that the hesitation stems more from a lack of perceived need or knowledge about usage than from specific issues.

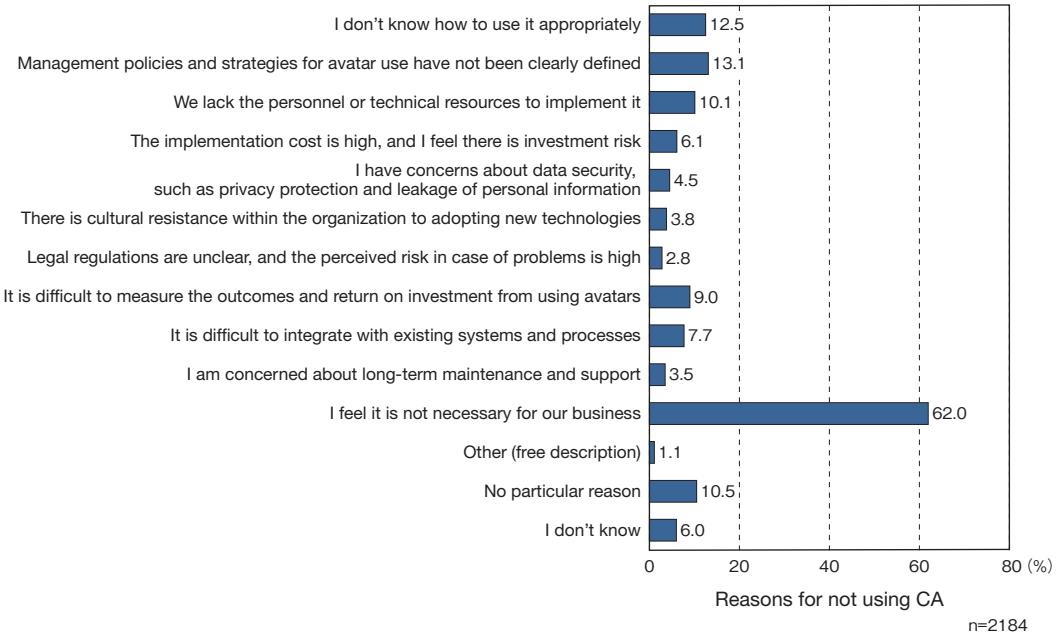
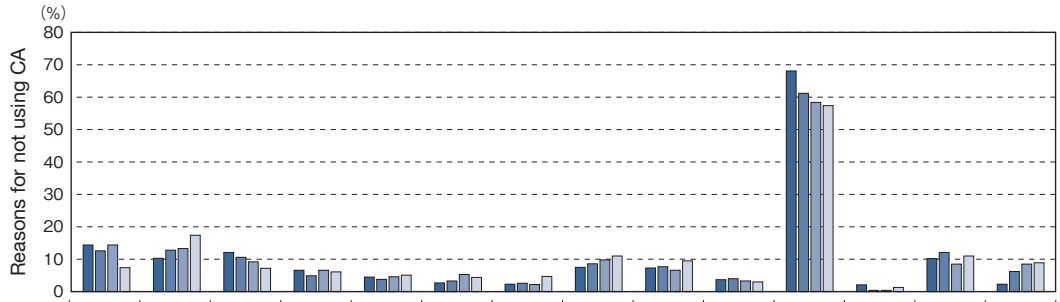


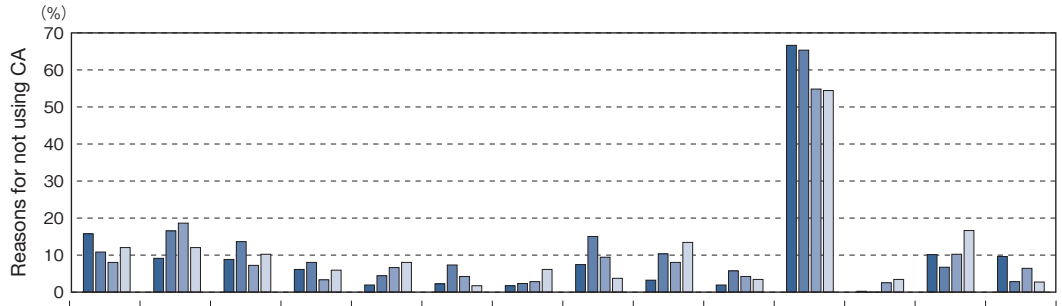
Figure 4.17 Reasons for not using CA (overall)



	I don't know how to use it appropriately	Management policies and strategies for avatar use have not been clearly defined	We lack the personnel or technical resources to implement it	The implementation cost is high, and I feel there is investment risk	I have concerns about data security, such as privacy protection and leakage of personal information	There is cultural resistance within the organization to adopting new technologies	Legal regulations are unclear, and the perceived risk in case of problems is high	It is difficult to measure the outcomes and return on investment from using avatars	It is difficult to integrate with existing systems and processes	I am concerned about long-term maintenance and support	I feel it is not necessary for our business	Other (free description)	No particular reason	I don't know
1–9	14.4%	10.3%	12.1%	6.6%	4.5%	2.7%	2.3%	7.5%	7.3%	3.7%	68.1%	2.1%	10.2%	2.3%
10–49	12.6%	12.8%	10.6%	4.9%	3.8%	3.3%	2.6%	8.6%	7.7%	4.0%	61.2%	0.4%	12.1%	6.2%
50–249	14.4%	13.3%	9.2%	6.6%	4.6%	5.3%	2.2%	9.8%	6.6%	3.3%	58.4%	0.4%	8.5%	8.5%
250 or more	7.4%	17.4%	7.2%	6.1%	5.1%	4.4%	4.7%	11.0%	9.5%	3.0%	57.4%	1.3%	11.0%	8.9%

n=2184

Figure 4.18 Reasons for not using CA (by company size)



	I don't know how to use it appropriately	Management policies and strategies for avatar use have not been clearly defined	We lack the personnel or technical resources to implement it	The implementation cost is high, and I feel there is investment risk	I have concerns about data security, such as privacy protection and leakage of personal information	There is cultural resistance within the organization to adopting new technologies	Legal regulations are unclear, and the perceived risk in case of problems is high	It is difficult to measure the outcomes and return on investment from using avatars	It is difficult to integrate with existing systems and processes	I am concerned about long-term maintenance and support	I feel it is not necessary for our business	Other (free description)	No particular reason	I don't know
Japan	15.7%	9.1%	8.8%	6.1%	1.9%	2.2%	1.7%	7.4%	3.2%	1.9%	66.6%	0.2%	10.1%	9.6%
South Korea	10.8%	16.5%	13.6%	8.0%	4.4%	7.3%	2.3%	15.0%	10.3%	5.7%	65.3%	0.0%	6.7%	2.8%
United States	8.0%	18.6%	7.2%	3.3%	6.6%	4.2%	2.8%	9.4%	8.0%	4.2%	54.8%	2.5%	10.2%	6.4%
Germany	12.0%	12.0%	10.2%	5.9%	8.0%	1.7%	6.1%	3.7%	13.4%	3.4%	54.4%	3.4%	16.6%	2.7%

n=2184

Figure 4.19 Reasons for not using CA (by country)

4.6. Interest in using CAs in companies

Regardless of whether companies were currently using CAs, we asked about their level of interest in each use case of CAs. Among those who responded "somewhat interested" or higher on a 7-point scale, the overall percentage was 62.5% (Figure 4.20). This indicates that more than 60% of companies have some level of interest in using CAs for business purposes.

By company size, companies with 50–249 employees (69.2%) and those with 250 or more employees (69.0%) showed high levels of interest, while companies with 1–9 employees had the lowest percentage at 49.9% (Figure 4.20). This suggests that companies above a certain size tend to show greater interest in the use of avatars.

By country, the United States had the highest percentage (74.8%), followed by South Korea (72.2%), Germany (70.7%), and Japan (32.1%) (Figure 4.21). Three countries showed over 70% interest, whereas Japan's figure was in the 30% range, indicating a notably lower level of interest in CAs.

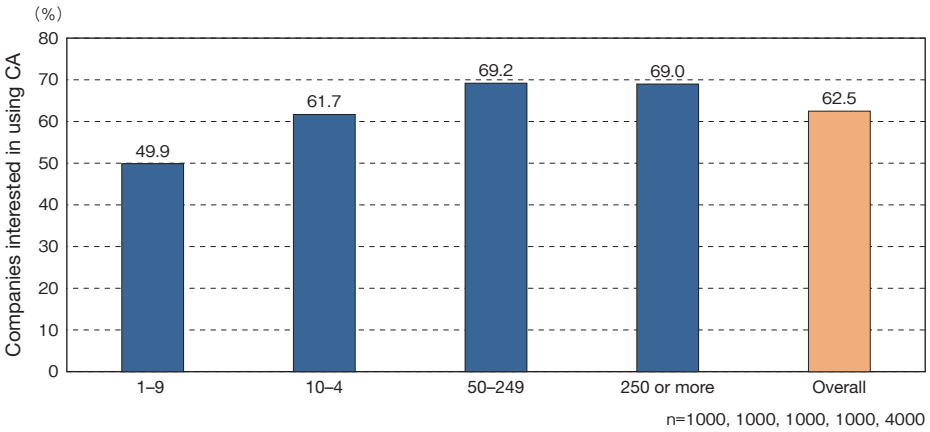


Figure 4.20 Companies interested in using CA (by company size and overall)

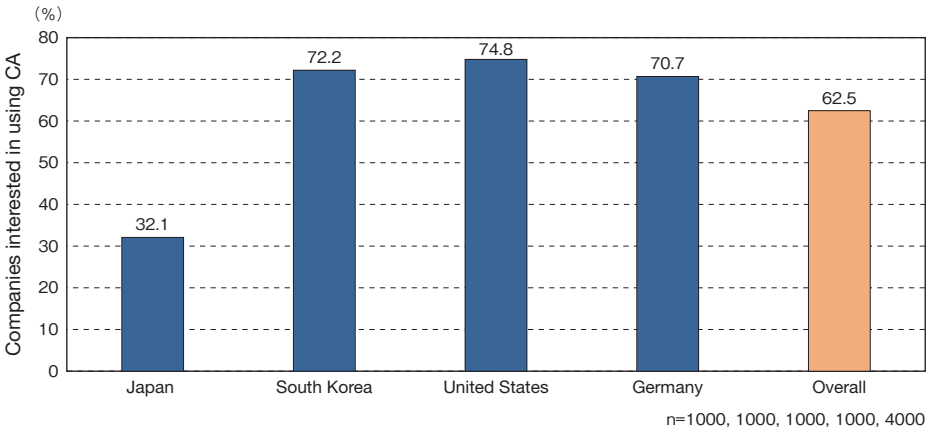


Figure 4.21 Companies interested in using CA (by country and overall)

When analyzing the breakdown of interest by use case among respondents who indicated "somewhat interested" or higher, the top response was "internal training and education" (43.8%), followed by "customer support and inquiry handling using avatars" (42.7%) and "internal communication (e.g., online meetings and video calls)" (42.7%) (Figure 4.22). While all items hovered around the 40% level with no dramatic differences, the first and third use cases were internal, indicating a tendency toward relatively greater interest in internal applications.

When examined by company size, item-specific trends showed no major differences. Overall, companies with 50–249 employees showed the highest level of interest, followed by those with 250 or more employees and those with 10–49 employees (Figure 4.23). Smaller companies showed lower levels of interest in CA use.

By country, the order of interest was generally consistent across the United States, South Korea, Germany, and Japan (Figure 4.24). Japan's levels were less than half those of the third-ranking country across all items, clearly showing that Japanese companies have a markedly lower interest in CA than companies in the other countries.

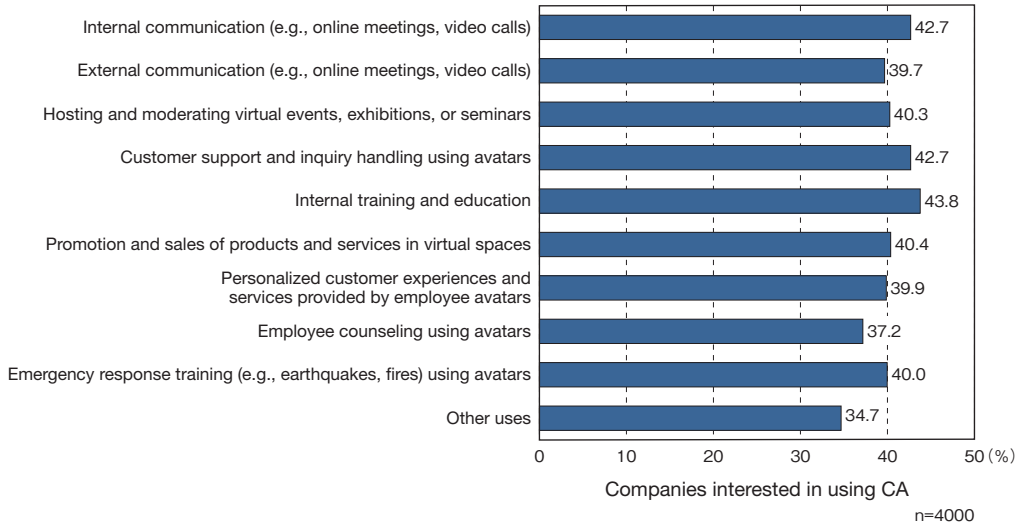
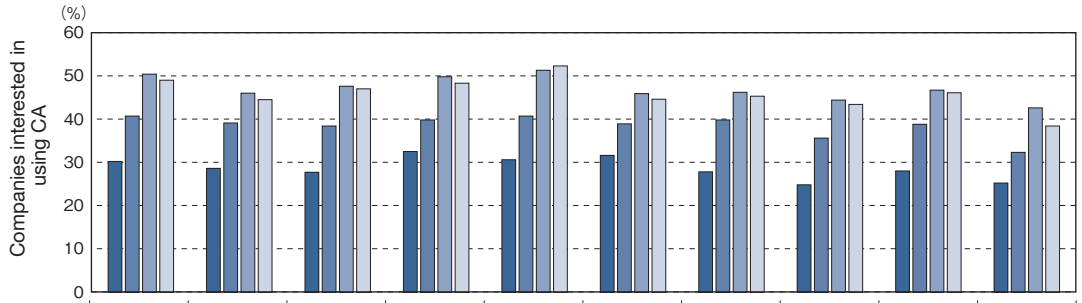


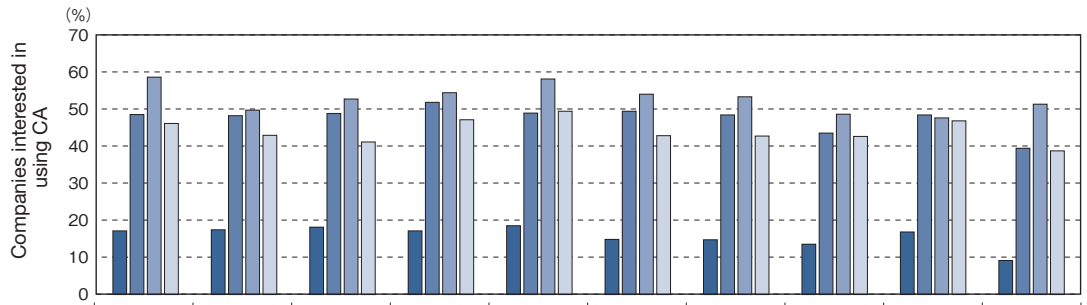
Figure 4.22 Areas of interest in using CA (overall)



	Internal communication (e.g., online meetings, video calls)	External communication (e.g., online meetings, video calls)	Hosting and moderating virtual events, exhibitions, or seminars	Customer support and inquiry handling using avatars	Internal training and education	Promotion and sales of products and services in virtual spaces	Personalized customer experiences and services provided by employee avatars	Employee counseling using avatars	Emergency response training (e.g., earthquakes, fires) using avatars	Other uses
1–9	30.3%	28.7%	27.8%	32.6%	30.7%	31.7%	27.9%	24.9%	28.1%	25.3%
10–49	40.8%	39.2%	38.5%	39.9%	40.8%	39.0%	39.9%	35.7%	38.9%	32.4%
50–249	50.5%	46.1%	47.7%	49.9%	51.4%	46.0%	46.3%	44.5%	46.8%	42.7%
250 or more	49.1%	44.6%	47.1%	48.4%	52.4%	44.7%	45.4%	43.5%	46.2%	38.5%

n=4000

Figure 4.23 Areas of interest in using CA (by company size)



	Internal communication (e.g., online meetings, video calls)	External communication (e.g., online meetings, video calls)	Hosting and moderating virtual events, exhibitions, or seminars	Customer support and inquiry handling using avatars	Internal training and education	Promotion and sales of products and services in virtual spaces	Personalized customer experiences and services provided by employee avatars	Employee counseling using avatars	Emergency response training (e.g., earthquakes, fires) using avatars	Other uses
Japan	17.2%	17.5%	18.2%	17.2%	18.6%	14.9%	14.8%	13.6%	16.9%	9.2%
South Korea	48.6%	48.3%	48.9%	51.9%	49.0%	49.5%	48.5%	43.6%	48.5%	39.5%
United States	58.7%	49.8%	52.8%	54.5%	58.2%	54.1%	53.4%	48.7%	47.7%	51.4%
Germany	46.2%	43.0%	41.2%	47.2%	49.5%	42.9%	42.8%	42.7%	46.9%	38.8%

n=4000

Figure 4.24 Areas of interest in using CA (by country)

4.7. Expectations and evaluations of CA use in companies

Regardless of current usage status, respondents were asked to what extent they expected each potential effect of CA usage, using a 7-point scale. The percentages presented below are based on those who responded "somewhat expected" or higher.

Overall, the most expected benefit was "the ability to express oneself without showing one's face enhances the quality of remote meetings and allows for a more relaxed atmosphere" (47.4%), followed by "smooth communication and collaboration are possible even with people from different countries and cultures" (45.0%), and "operating events in virtual spaces allows for reaching a diverse range of participants" (44.8%) (Figure 4.25). These results indicate that the primary expectation of CA use is to facilitate communication both inside and outside the company, followed by expanding customer access and improving customer satisfaction.

By company size, the trend was consistent across items, with expectations highest among companies with 50–249 employees, followed by those with 250 or more, 10–49, and 1–9 employees, in that order (Figure 4.26).

Expectations were generally highest in the United States, followed by South Korea, Germany, and Japan for almost all items (Figure 4.27). In particular, Japan's figures were less than half of Germany's in nearly all categories, revealing that expectations for CAs in Japan are markedly lower than in other countries.

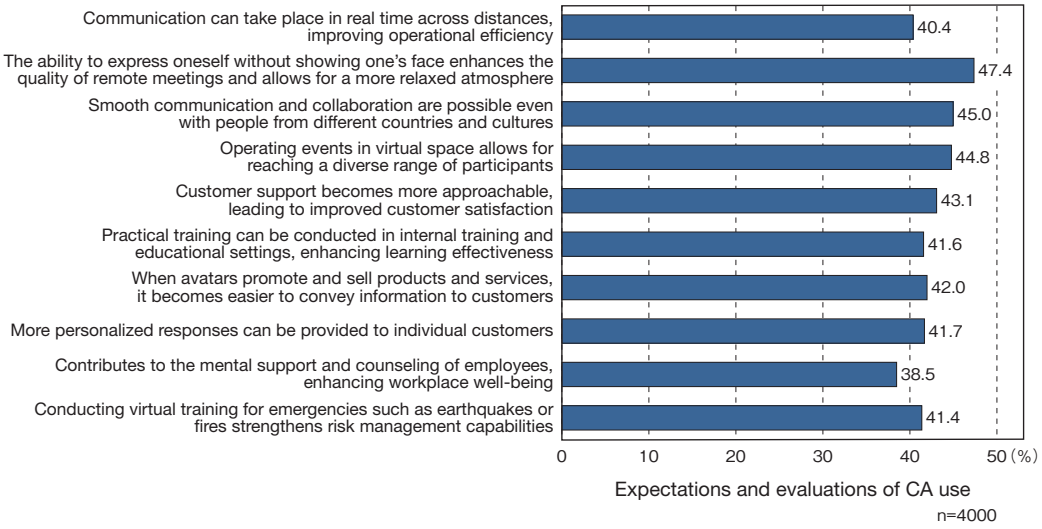
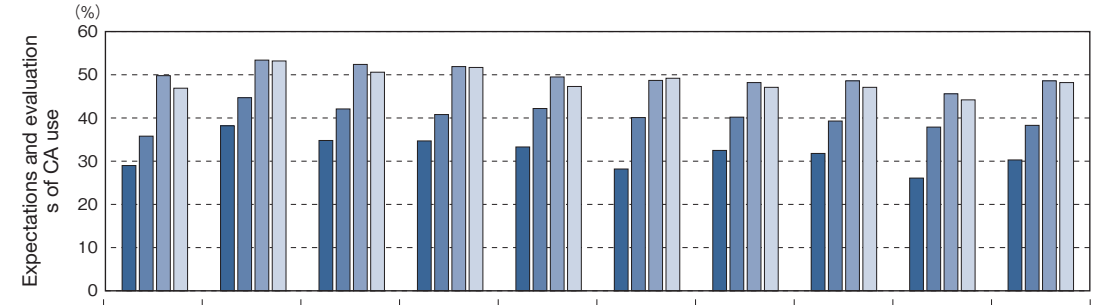


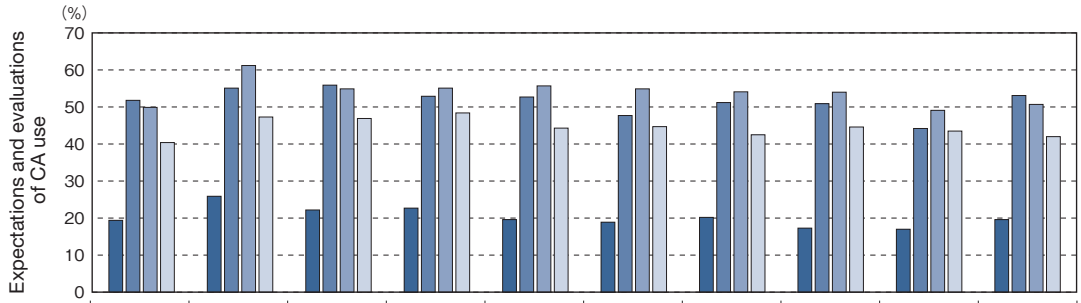
Figure 4.25 Expectations of CA (overall)



	Communication can take place in real time across distances, improving operational efficiency	The ability to express oneself without showing one's face enhances the quality of remote meetings and allows for a more relaxed atmosphere	Smooth communication and collaboration are possible even with people from different countries and cultures	Operating events in virtual space allows for reaching a diverse range of participants	Customer support becomes more approachable, leading to improved customer satisfaction	Practical training can be conducted in internal training and educational settings, enhancing learning effectiveness	When avatars promote and sell products and services, it becomes easier to convey information to customers	More personalized responses can be provided to individual customers	Contributes to the mental support and counseling of employees, enhancing workplace well-being	Conducting virtual training for emergencies such as earthquakes or fires strengthens risk management capabilities
1–9	29.0%	38.2%	34.8%	34.7%	33.3%	28.2%	32.5%	31.8%	26.1%	30.3%
10–49	35.8%	44.7%	42.1%	40.8%	42.2%	40.1%	40.2%	39.3%	37.9%	38.3%
50–249	49.8%	53.4%	52.4%	51.9%	49.5%	48.7%	48.2%	48.6%	45.6%	48.6%
250 or more	46.9%	53.2%	50.6%	51.7%	47.3%	49.2%	47.1%	47.1%	44.2%	48.2%

n=4000

Figure 4.26 Expectations of CA (by company size)



	Communication can take place in real time across distances, improving operational efficiency	The ability to express oneself without showing one's face enhances the quality of remote meetings and allows for a more relaxed atmosphere	Smooth communication and collaboration are possible even with people from different countries and cultures	Operating events in virtual space allows for reaching a diverse range of participants	Customer support becomes more approachable, leading to improved customer satisfaction	Practical training can be conducted in internal training and educational settings, enhancing learning effectiveness	When avatars promote and sell products and services, it becomes easier to convey information to customers	More personalized responses can be provided to individual customers	Contributes to the mental support and counseling of employees, enhancing workplace well-being	Conducting virtual training for emergencies such as earthquakes or fires strengthens risk management capabilities
Japan	19.4%	25.9%	22.2%	22.7%	19.6%	18.9%	20.2%	17.3%	17.0%	19.6%
South Korea	51.8%	55.1%	55.9%	52.9%	52.7%	47.7%	51.2%	50.9%	44.2%	53.1%
United States	49.9%	61.2%	54.9%	55.1%	55.7%	54.9%	54.1%	54.0%	49.1%	50.7%
Germany	40.4%	47.3%	46.9%	48.4%	44.3%	44.7%	42.5%	44.6%	43.5%	42.0%

n=4000

Figure 4.27 Expectations of CA (by country)

4.8. Concerns about the use of CAs in companies

Regardless of whether respondents currently use CAs, we asked about the extent to which they were concerned about potential issues associated with CA use, using a 7-point scale. We compiled the responses from those who answered "somewhat concerned" or higher. Overall, the most commonly cited concern was "impersonation of avatars by others" (56.0%), followed by "leakage or misuse of data collected during avatar use" (55.6%) and "unauthorized access to or tampering with avatars or virtual spaces" (54.6%) (Figure 4.28). These results suggest that when introducing CAs, concerns related to cybersecurity, such as unauthorized access or data breaches, outweigh concerns about communication issues or employee dissatisfaction.

When examined by company size, no significant differences were observed in trends by item. However, companies with 50 or more employees showed an approximately 5% higher level of concern across the board (Figure 4.29).

South Korea stood out with notably higher concern across nearly all items, whereas the other three countries displayed relatively similar levels. For issues of a psychological nature that may arise from CA use, such as "customers or employees feeling dissatisfied due to the impersonality of avatars in customer interaction or counseling," "problematic behavior such as sexual harassment, customer harassment, molestation, or bullying," and "dependence on avatars or virtual space," concerns were more pronounced in the United

States than in Japan or Germany (Figure 4.30).

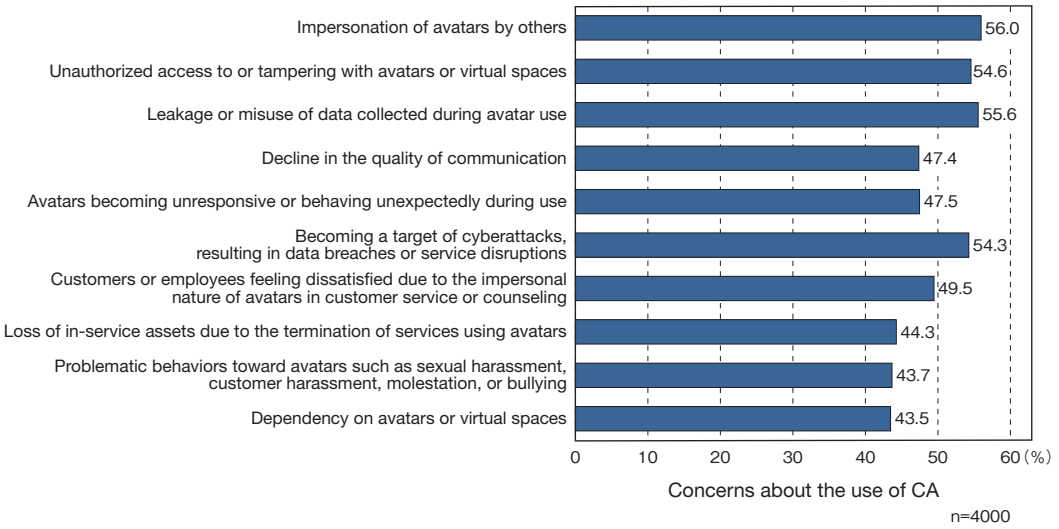
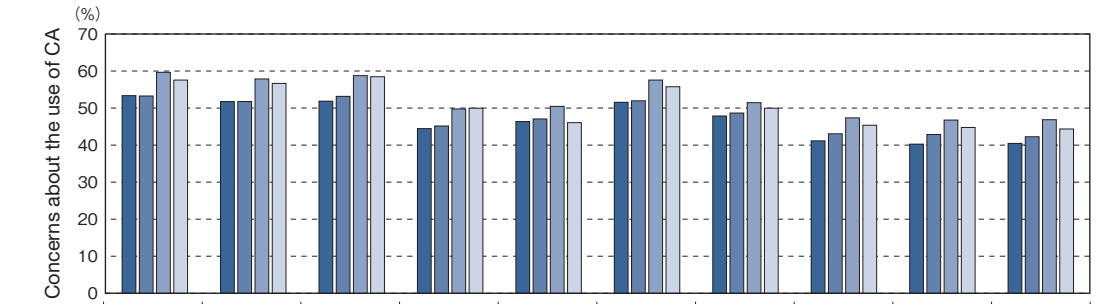


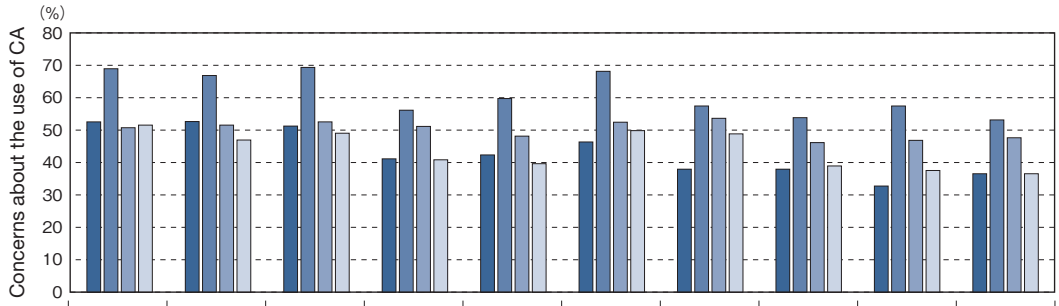
Figure 4.28 Concerns about CA use (overall)



	Impersonation of avatars by others	Unauthorized access to or tampering with avatars or virtual spaces	Leakage or misuse of data collected during avatar use	Decline in the quality of communication	Avatars becoming unresponsive or behaving unexpectedly during use	Becoming a target of cyberattacks, resulting in data breaches or service disruptions	Customers or employees feeling dissatisfied due to the impersonal nature of avatars in customer service or counseling	Loss of in-service assets due to the termination of services using avatars	Problematic behaviors toward avatars such as sexual harassment, customer harassment, molestation, or bullying	Dependency on avatars or virtual spaces
1–9	53.4%	51.8%	51.9%	44.5%	46.4%	51.6%	47.9%	41.2%	40.3%	40.5%
10–49	53.3%	51.8%	53.2%	45.2%	47.1%	52.0%	48.7%	43.1%	42.9%	42.3%
50–249	59.7%	57.9%	58.8%	49.8%	50.5%	57.6%	51.5%	47.4%	46.8%	46.9%
250 or more	57.6%	56.7%	58.5%	50.0%	46.1%	55.8%	50.0%	45.4%	44.8%	44.4%

n=4000

Figure 4.29 Concerns about CA use (by company size)



	Impersonation of avatars by others	Unauthorized access to or tampering with avatars or virtual spaces	Leakage or misuse of data collected during avatar use	Decline in the quality of communication	Avatars becoming unresponsive or behaving unexpectedly during use	Becoming a target of cyberattacks, resulting in data breaches or service disruptions	Customers or employees feeling dissatisfied due to the impersonal nature of avatars in customer service or counseling	Loss of in-service assets due to the termination of services using avatars	Problematic behaviors toward avatars such as sexual harassment, customer harassment, molestation, or bullying	Dependency on avatars or virtual spaces
Japan	52.6%	52.7%	51.3%	41.2%	42.4%	46.4%	38.0%	38.0%	32.8%	36.6%
South Korea	69.0%	66.9%	69.4%	56.2%	59.8%	68.2%	57.5%	53.9%	57.5%	53.2%
United States	50.8%	51.6%	52.6%	51.2%	48.2%	52.5%	53.7%	46.2%	46.9%	47.7%
Germany	51.6%	47.0%	49.1%	40.9%	39.7%	49.9%	48.9%	39.0%	37.6%	36.6%

n=4000

Figure 4.30 Concerns about CA use (by country)

4.9. Perceived investment value of CAs

This section presents the results of a survey on how respondents perceived the investment value of each of the nine CA use cases covered in this chapter. For countries other than Japan, responses were collected in local currencies and converted into Japanese yen.

First, the total investment value across all items was JPY 5.175 million (Figure 4.31). When broken down by company size, perceived value increased in a stepwise manner: JPY 9.057 million for companies with 250 or more employees, JPY 6.459 million for those with 50–249 employees, JPY 3.574 million for companies with 10–49 employees, and JPY 1.608 million for companies with 1–9 employees (Figure 4.31). These results indicate that the larger the company, the greater the perceived investment value of CAs.

South Korea perceived the highest investment value at JPY 6.973 million, followed by the United States at JPY 6.963 million and Germany at JPY 5.093 million. Japan had the lowest valuation at JPY 1.669 million (Figure 4.32). Compared to other countries, this suggests that Japanese companies perceive relatively little value in adopting CA for business use.

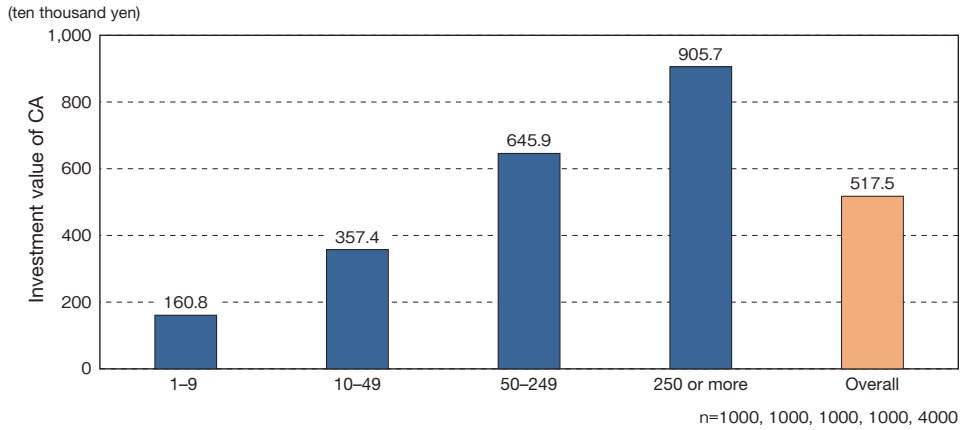


Figure 4.31 Total perceived investment value of CAs (by company size + overall)

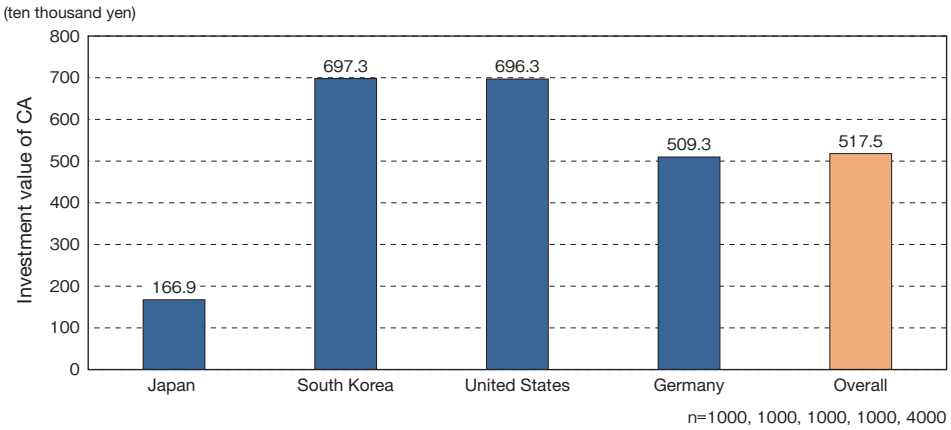


Figure 4.32 Total perceived investment value of CAs (by country + overall)

When examining perceived value by use case, "promotion and sales of products and services in virtual spaces" ranked highest at JPY 681,000, followed by "personalized customer experiences and services provided by employee avatars" (JPY 642,000) and "customer support and inquiry handling using avatars" (JPY 637,000). In contrast, "internal communication (e.g., online meetings, video calls)," which had the highest usage rate, was perceived as the least valuable at JPY 436,000 (Figure 4.33). These findings suggest that companies perceive greater value in use cases involving direct interactions with customers, whereas the value of internal communication is relatively low.

When analyzed by company size, larger companies consistently reported higher investment values across all use cases, with no major variation by type of use (Figure 4.34).

South Korea and the United States generally indicated higher perceived investment values across most categories, with no significant trend differences observed (Figure 4.35). In Japan, the use case with the highest perceived value was "serving as a host or facilitator for virtual events, exhibitions, and seminars" (22.3%).

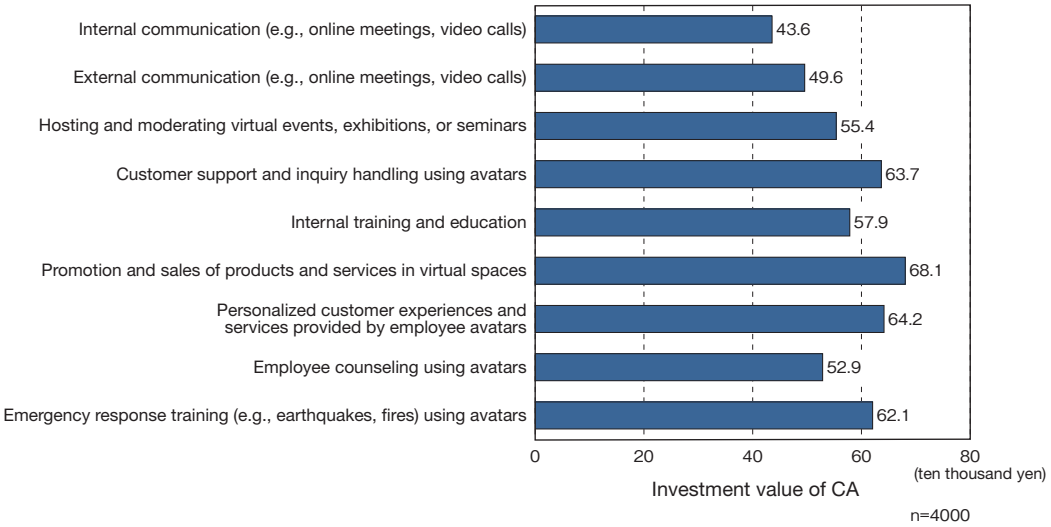
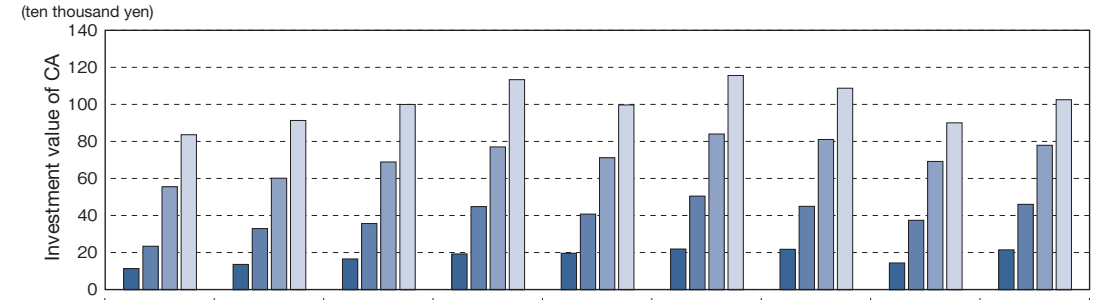


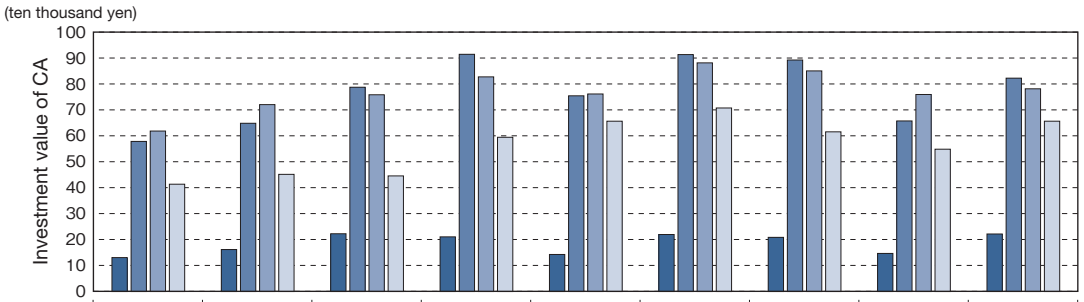
Figure 4.33 Perceived investment value by avatar use case (overall)



	Internal communication (e.g., online meetings, video calls)	External communication (e.g., online meetings, video calls)	Hosting and moderating virtual events, exhibitions, or seminars	Customer support and inquiry handling using avatars	Internal training and education	Promotion and sales of products and services in virtual spaces	Personalized customer experiences and services provided by employee avatars	Employee counseling using avatars	Emergency response training (e.g., earthquakes, fires) using avatars
1–9	11.45	13.70	16.66	19.36	19.74	22.01	21.86	14.49	21.58
10–49	23.51	33.04	35.76	44.90	40.87	50.59	45.06	37.52	46.13
50–249	55.63	60.25	69.01	77.15	71.29	84.11	81.15	69.30	78.02
250 or more	83.71	91.42	100.06	113.45	99.81	115.71	108.84	90.14	102.62

n=4000

Figure 4.34 Perceived investment value by avatar use case (by company size)



	Internal communication (e.g., online meetings, video calls)	External communication (e.g., online meetings, video calls)	Hosting and moderating virtual events, exhibitions, or seminars	Customer support and inquiry handling using avatars	Internal training and education	Promotion and sales of products and services in virtual spaces	Personalized customer experiences and services provided by employee avatars	Employee counseling using avatars	Emergency response training (e.g., earthquakes, fires) using avatars
Japan	13.1	16.2	22.3	21.1	14.3	22.0	20.9	14.7	22.2
South Korea	57.9	64.9	78.8	91.5	75.5	91.4	89.3	65.8	82.3
United States	61.9	72.1	75.9	82.8	76.2	88.2	85.1	76.0	78.2
Germany	41.4	45.2	44.6	59.5	65.7	70.8	61.6	54.9	65.7

n=4000

Figure 4.35 Perceived investment value by avatar use case (by country)

Since perceptions of the investment value of CA use may be influenced by various factors, such as organizational characteristics and individual respondent attributes (e.g., gender and age), a model was constructed to examine these perceptions in the context of corporate CA use, and a regression analysis was conducted. The analysis revealed the following findings:

Among organizational characteristics, companies with a high frequency of remote work, large sales volumes, a large number of employees, and those headquartered in metropolitan areas were more likely to perceive high investment value in CAs. Conversely, companies engaged primarily in consumer-facing (B2C) businesses tended to perceive lower investment value.

Regarding individual respondents' attributes, those who used avatars in their private lives were more likely to assign higher values to them in business contexts. However, women, older individuals, and those with a longer history of internet use tended to perceive lower investment value.

Finally, South Korean respondents tended to perceive a significantly higher investment value for the corporate use of CA than their Japanese counterparts. No statistically significant differences were found between respondents from the United States or Germany and those from Japan.

5

CAs and purchasing behavior

Following the emergence of e-commerce, consumer purchasing behavior, previously centered on physical stores, gradually shifted online. The development of CA-based commerce currently underway presents the potential to enable shopping within VR, offering consumers a new purchasing experience that differs from traditional retail and e-commerce. This chapter examines how CA-based commerce is likely to be rooted in consumer purchasing behavior.

Specifically, the following three points are evaluated from the consumer's perspective: (1) the extent to which CA-based commerce is currently recognized by consumers, (2) the industries in which it is likely to expand in the future, and (3) the kinds of benefits the VR-based shopping experience offers consumers compared to physical stores or online purchases.

The analysis is based on the results of an online survey conducted in October 2024. The respondents were men and women aged 20–69 years across Japan, selected in accordance with the Japanese population distribution by region (Kanto, Tokai, Kinki, and others). In total, 1,000 valid responses were collected. The findings of the survey are as follows.

5.1. Awareness and use of CA-based shopping experiences

First, the survey asked respondents to identify all industries in which they were aware of shopping conducted in VR spaces. The industry with the highest level of awareness was "Games/Movies" at 42.9%, followed by "Apparel" (28.1%) and "Travel" (22.5%) (Figure 5.1). In the case of apparel, CAs may play a role in replicating the strengths of physical stores, for example, through virtual try-ons within VR, thus compensating for the difficulties consumers often face when comparing products on basic e-commerce platforms. Regarding travel, the emergence of virtual travel services during the COVID-19 pandemic is likely to have contributed to its recognition. In contrast, awareness in other industries remained below 15%, indicating that CA-based shopping is still at an early stage of development.

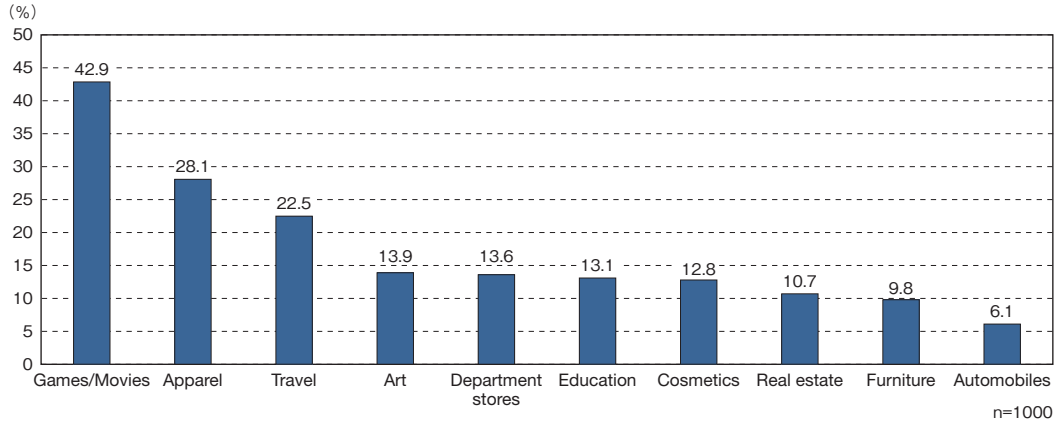


Figure 5.1 Awareness rates of shopping in VR spaces using CAs

Next, respondents who indicated awareness of each industry were asked whether they had ever shopped using CAs in those industries. The overall trend mirrored that of awareness: "Games/Movies" had the highest usage rate at 15.9%. In contrast, industries such as "Furniture" (9.2%), "Real Estate" (8.4%), and "Automobiles" (8.2%) recorded higher usage rates than "Apparel" (7.1%) and "Travel" (6.2%), despite their lower awareness levels (Figure 5.2). This suggests that practical applications, such as virtual furniture fitting, property tours, and test-driving vehicles, tend to be more readily used once they are recognized, indicating their high potential for future adoption.

Nevertheless, even in the case of "Games/Movies," the category with the highest usage rate, only 15.9% of respondents reported actually using CAs. For all other industries, usage rates remained below 10%, indicating that actual engagement is still limited.

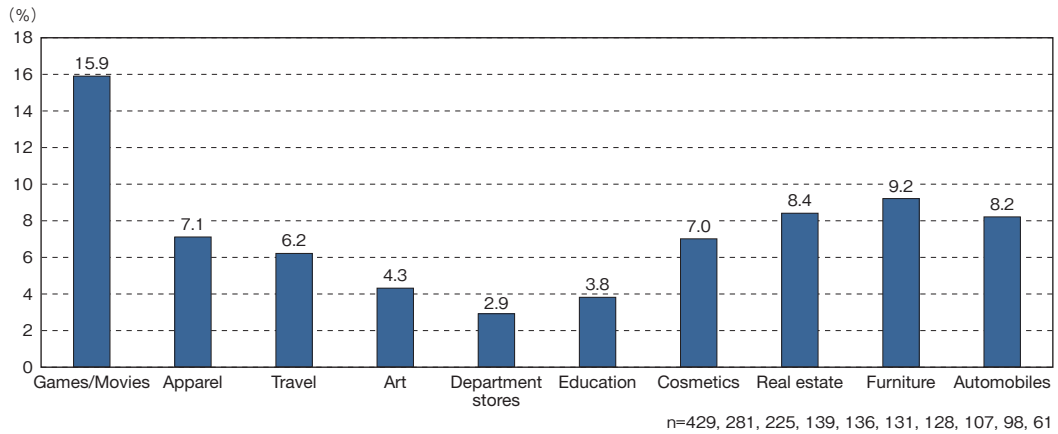
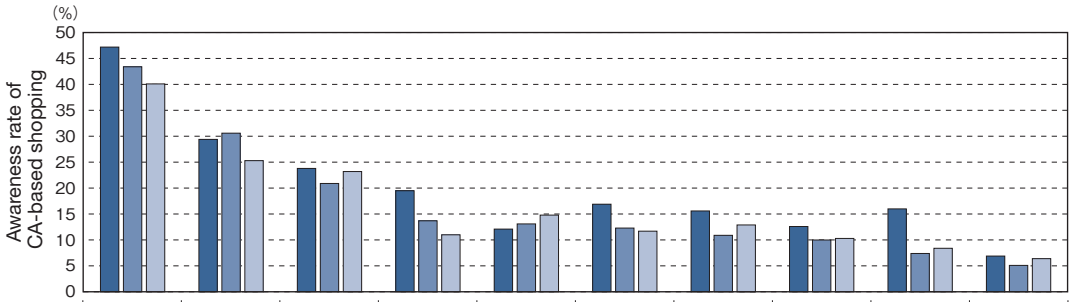


Figure 5.2 Usage rates of shopping in VR spaces using CAs

The awareness data in Figure 5.1 are broken down by age group. Recognition of industries such as "Games/Movies," "Art," "Furniture," "Education," and "Cosmetics" was higher among respondents aged 20–34 than among those in other age groups. Conversely, recognition of "Department Stores" was higher

among respondents aged 50–69 (Figure 5.3). These results indicate age-based differences in recognized industries.

However, even the largest gap—between age groups in the "Games/Movies" category—was only 7.1 percentage points, indicating no extreme disparity in awareness across age cohorts.



	Games/ Movies	Apparel	Travel	Art	Depart-ment stores	Education	Cosmetics	Real estate	Furniture	Automo-biles
Age 20-34	47.2%	29.4%	23.8%	19.5%	12.1%	16.9%	15.6%	12.6%	16.0%	6.9%
Age 35-49	43.4%	30.6%	20.9%	13.7%	13.1%	12.3%	10.9%	10.0%	7.4%	5.1%
Age 50-69	40.1%	25.3%	23.2%	11.0%	14.8%	11.7%	12.9%	10.3%	8.4%	6.4%

n=231, 350, 419

Figure 5.3 Awareness rate of shopping in VR spaces using CA (by age group)

5.2. Recognition and use of actual services

Next, we surveyed the recognition and usage of specific services that are currently in operation, using a four-point scale ranging from "have actually used" to "do not even know the name." The services included in the survey were: "Virtual Market," an event that enables buying and selling of products in the metaverse; "REV WORLDS," a virtual urban space service for smartphones where users can shop at a virtual Isetan Shinjuku store using a CA; "Metapa," a shopping mall in a metaverse; and "ANA Gran Whale," a platform for virtual travel using a virtual travel agent. As related services, we also asked about "VIRTUAL MAKEUP" by Shiseido, which enables users to try on cosmetics using AR technology, as well as Nitori's "NITORI AR" and IKEA's "IKEA Place."

In terms of actual usage, AR services showed relatively higher percentages of users who had either "used the service" or were "considering using it." However, across all services, approximately 80–90% of respondents answered that they "did not even know the name," indicating a low overall level of recognition (Figure 5.4). To encourage broader adoption of CA-based shopping services, companies must first raise consumer awareness of service names and ensure basic recognition.

Among VR-based services, "Virtual Market" had the highest recognition rate. However, a breakdown of responses shows that 11.2% of respondents said they "know the name but do not intend to use it," whereas only 2.5% said they were "considering using it." After raising awareness, organizations must develop measures that encourage actual use.

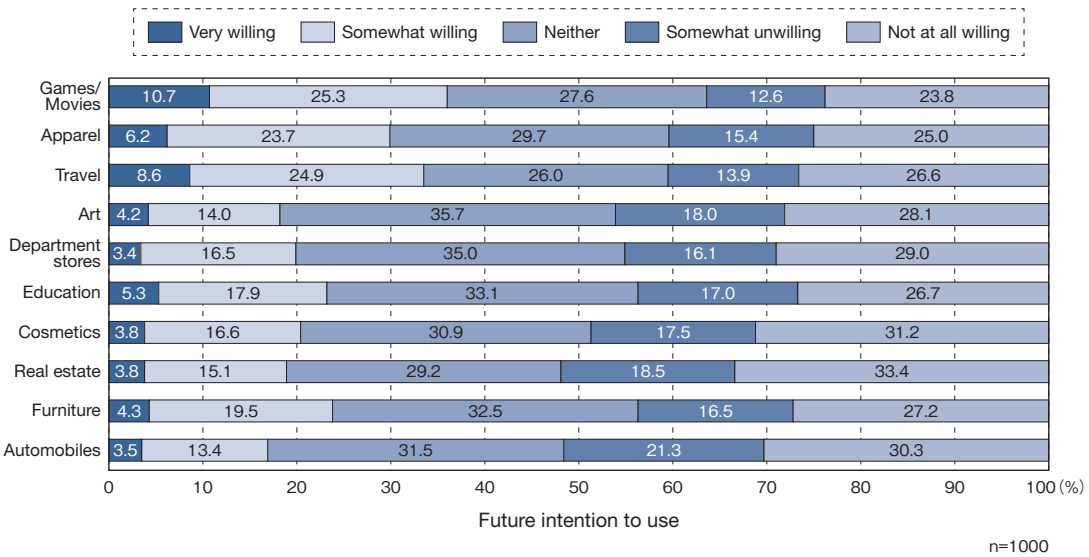
Figure 5.4 Degree of recognition and usage of actual services

	Did not even know the name	Know the name but do not intend to use	Considering using	Have used
Virtual Market	85.9%	11.2%	2.5%	0.4%
REV WORLDS by Isetan	91.7%	5.5%	2.4%	0.4%
Metapa	88.3%	8.6%	2.5%	0.6%
ANA GranWhale	89.4%	7.3%	2.5%	0.8%
VIRTUAL MAKEUP by Shiseido	88.0%	7.9%	3.5%	0.6%
NITORI「NITORI AR」	84.0%	9.7%	4.7%	1.6%
IKEA「IKEA Place」	88.6%	6.8%	3.8%	0.8%

n=1000

5.3. Future of shopping using CAs

To examine the potential for broader adoption of CA-based shopping, we asked respondents about their willingness to use such services across various industries. A five-point scale was used, ranging from "very willing" to "not at all willing." In the cases of "games/movies," "travel," and "apparel," the percentage of respondents who answered either "very willing" or "somewhat willing" exceeded 30%, indicating a relatively high level of interest. However, even for "games/movies," which had the highest intention to use, only about 10% of respondents selected "very willing" (Figure 5.5). This suggests that a future challenge lies in effectively communicating the value of CA-based shopping and increasing consumers' intentions to use it.

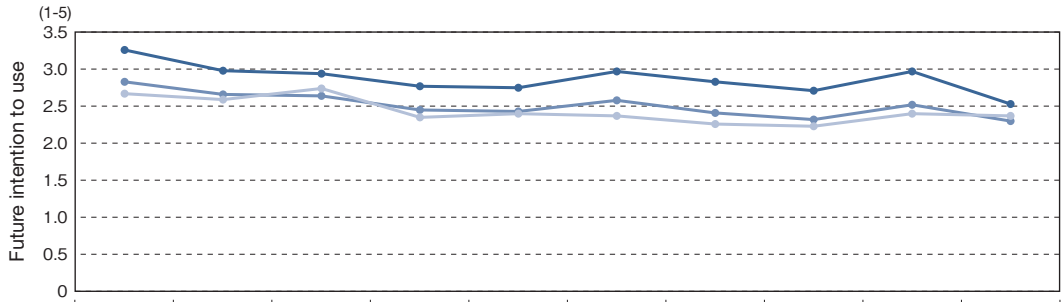


n=1000

Figure 5.5 Future intention to use CAs for shopping in VR spaces

In addition, scores were calculated using a five-point scale ("very willing" = 5, "not at all willing" = 1), and the average scores were cross-tabulated by industry and age group. The results show that across all industries, the intention to use was consistently higher among respondents aged 20–34 years (Figure 5.6). This trend indicates that new technologies such as CAs are more readily accepted by younger generations.

The industry with the smallest gap between age groups was "travel." For seniors who find long-distance travel physically burdensome, CA-based services can extend the capabilities of their physical bodies and offer new types of travel experiences. The extent to which older generations are receptive to digital experiences is also an important factor for the broader adoption of such services in the future.



	Games/ Movies	Apparel	Travel	Art	Depart-ment stores	Education	Cosmetics	Real estate	Furniture	Automo-biles
Age 20-34	3.26	2.98	2.94	2.77	2.75	2.97	2.83	2.71	2.97	2.53
Age 35-49	2.83	2.66	2.64	2.45	2.43	2.58	2.41	2.32	2.52	2.3
Age 50-69	2.67	2.59	2.74	2.35	2.40	2.37	2.26	2.23	2.40	2.37

n=231, 350, 419

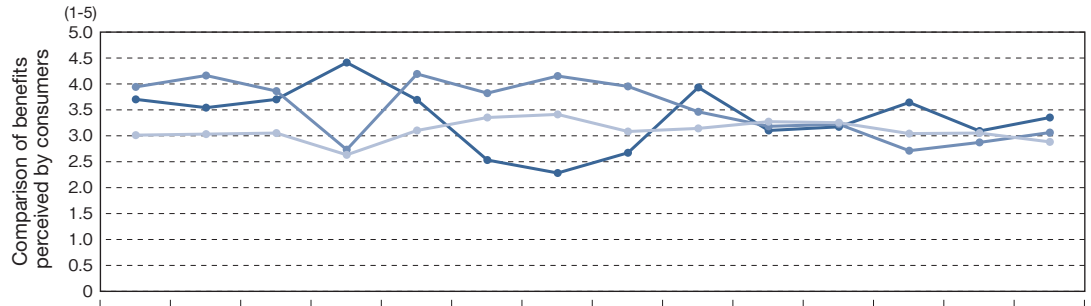
Figure 5.6 Future intention to use CAs for shopping in VR spaces (average score, by age group)

5.4. Comparison of benefits perceived by consumers

This section compares consumer-perceived benefits between shopping in VR spaces and traditional channels, including physical stores and e-commerce. For each shopping channel, consumer perceptions were surveyed, and average scores were calculated using a five-point scale, from "strongly applies" (5 points) to "does not apply at all" (1 point).

First, comparing the traditional channels, physical stores scored highest for "easy to obtain immediately" (4.41), followed by "shopping is enjoyable" (3.93) and "stimulates the five senses" (3.64), with lower scores on risk-related items. Online shopping, on the other hand, scored highest for "convenient" (4.19), followed by "easy to compare prices" (4.16) and "high risk of receiving a product different from expectations" (4.15) (Figure 5.7). These results clearly indicate that physical and online channels have distinct strengths and weaknesses that consumers are likely to leverage in a complementary manner.

In contrast, the results for VR shopping show less pronounced strengths compared to physical stores and e-commerce, with most scores hovering around 3 points, corresponding to "neither" (Figure 5.7). Consumers seem to struggle to envision the unique advantages that VR shopping offers. Notably, the items "personalized experience" and "immersive experience," which were included in the survey to capture the specific merits of VR, received scores similar to those for existing channels. This indicates that consumers do not yet widely perceive these potential advantages.



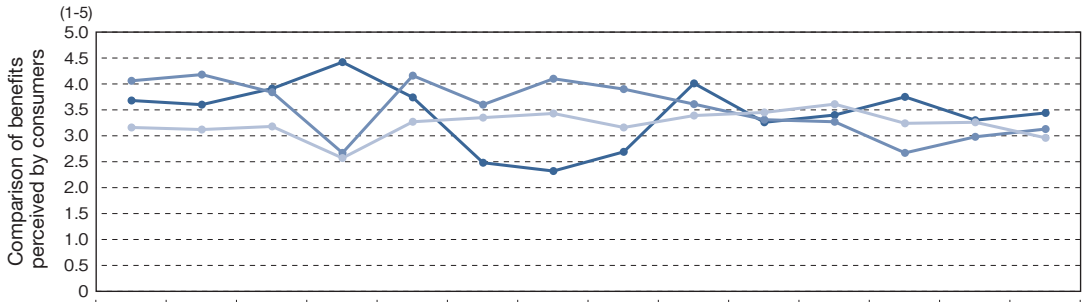
	Easy to search for product information	Easy to compare prices	Easy to compare product selection	Easy to obtain immediately	Convenient	High risk of information leakage	High risk of receiving a product different from expectations	Easy to save time	Shopping is enjoyable	Can receive a personalized experience	Provides an immersive experience	Stimulates the five senses	Enables self-expression	Well-developed customer service
Physical store	3.7	3.54	3.7	4.41	3.69	2.53	2.28	2.67	3.93	3.1	3.17	3.64	3.09	3.35
E-commerce	3.94	4.16	3.86	2.73	4.19	3.82	4.15	3.95	3.46	3.18	3.22	2.71	2.87	3.06
VR	3.01	3.03	3.05	2.63	3.1	3.35	3.41	3.08	3.14	3.27	3.25	3.04	3.05	2.88

n=1000

Figure 5.7 Comparison of benefits perceived by consumers

We conducted the same comparison limited to respondents aged 20–34 years, who showed a higher intention to use VR services. However, no major differences were observed compared to the overall trend (Figure 5.8). In terms of VR's perceived strengths, "getting a personalized experience" scored 3.45 and "being immersive" scored 3.61, slightly higher than the scores for physical and online channels, but the differences were not substantial enough to indicate a clear advantage.

For future diffusion, two strategic directions are worth considering: a complementary approach that enhances aspects not addressed by current physical or online shopping, and a synergistic approach that integrates various channels to further enhance the value of both physical stores and e-commerce. Presently, VR shopping is not yet widely adopted, and its value is not fully recognized by consumers. Continued monitoring and research are necessary to track future developments.



	Easy to search for product information	Easy to compare prices	Easy to compare product selection	Easy to obtain immediately	Convenient	High risk of information leakage	High risk of receiving a product different from expectations	Easy to save time	Shopping is enjoyable	Can receive a personalized experience	Provides an immersive experience	Stimulates the five senses	Enables self-expression	Well-developed customer service
Physical store	3.68	3.6	3.91	4.42	3.74	2.48	2.32	2.69	4.01	3.26	3.4	3.75	3.3	3.44
E-commerce	4.06	4.18	3.84	2.67	4.16	3.6	4.1	3.9	3.61	3.31	3.27	2.67	2.98	3.13
VR	3.16	3.12	3.18	2.57	3.27	3.35	3.43	3.16	3.39	3.45	3.61	3.24	3.26	2.96

n=231

Figure 5.8 Comparison of benefits perceived by consumers (ages 20–34)

6

Public perceptions of identity in relation to CAs (international comparison)

This chapter clarifies how users perceive the issue of identity associated with the use of CAs, based on a questionnaire survey conducted among CA users in Japan, South Korea, the United States, and Germany.

6.1. Nature of the issue

This section first explains why the issue of identity arises when using CAs. This issue can be understood through the concept of bunjin-shugi ("dividualism").[52] A "dividual" refers to aspects of the self that emerge in interaction with others—such as having different roles at work, at home, or with friends—unlike a stable "individual," who remains unchanged across environments. A CA in the metaverse can be regarded as one such manifestation of a dividual. Unlike real-world dividuals, CAs allow users to fully change age, gender, and appearance, greatly expanding the possibilities for expressing identity.

A key problem with CAs in the metaverse is maintaining identity. Here, "identity" refers to the ability to confidently recognize a specific individual based on a CA's design.[53] In the real world, people remain relatively easy to identify even when they behave differently across contexts, and impersonation proves difficult. In metaverse environments, identity becomes unstable because users can easily create, modify, or delete multiple CAs. Impersonation is common, but other potential abuses include self-promotion through fabricated praise, spreading misinformation, and malicious stalking.

To address this, some have proposed restrictions on CA creation and modification—for example, allowing only one CA per person and prohibiting subsequent changes. However, such limits risk reducing the enjoyment of the metaverse, where the freedom to customize appearance is a major appeal. The core issue is thus the trade-off between the safety provided by stable identity and the convenience offered by flexible CA customization.

This problem is not new; it has existed on the internet, as seen in debates over real-name policies. However, it is likely to become more serious in metaverse social media owing to its higher level of immersion compared with largely text-based traditional platforms. For many users, CAs are not merely a tool but a personal representation imbued with emotional attachment. When a CA is impersonated or misused, the resulting psychological harm can be substantial, with potential disruptions to the social order within the metaverse. Legal and engineering scholars have recently focused on these issues, with legal discussions em-

52. Hirano, K. (2012). *What is Me: From "Individual" to "Partito."* Kodansha.

53. Social psychology includes a long discussion about so-called self-identity, but we will not pursue that here and use "identity" simply to mean that others can recognize the same person.

phasizing concepts such as the "right to one's portrait" and the "right to control one's self-image." [54] [55]

At present, these problems have not yet become prominent, likely because the metaverse is still in its early stages and user participation is limited. During the development of social media, the early stages proceeded smoothly when user bases were small and composed of conscientious individuals; however, as participation increased, problems began to emerge. A similar pattern is expected as the metaverse evolves.

6.2. Survey overview and CA usage status

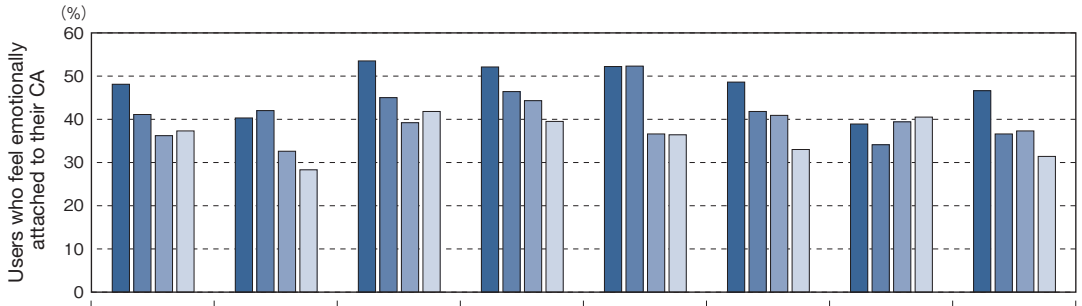
This section outlines the method and results of the survey on the degree of emotional attachment to CAs. The data used were the same as those in Chapter 2, and respondents were limited to individuals who currently use CAs.

The specific survey item asked, "If you were asked whether your CA is a tool or your alter ego, how would you respond?" Respondents answered on a 5-point scale, where 1 = "It is a tool, and I feel no attachment," and 5 = "It is my alter ego, and I feel attached to it." Those who responded with 3 ("It is both a tool and my alter ego") or higher were counted as users who feel emotional attachment to their CA, and the proportion was calculated.

The results show that, in all four countries and across all use cases, approximately 40% of respondents indicated that they felt an attachment to their CA (Figure 6.1). Overall, the percentage of users who felt emotionally attached to their CA was high. Notably, attachment was not limited to entertainment or social interaction domains, where it might be more intuitively expected, but was also observed among those who used CA for more practical purposes. Of the four countries, Japan recorded the highest attachment rate across the widest range of domains.

However, when the analysis was restricted to users whose CA use was solely for practical purposes, excluding entertainment and social interaction, the percentage of respondents who regarded their CA as an alter ego dropped to approximately 30% (Figure 6.2). This suggests that entertainment and interaction are core use cases that foster emotional attachment to CAs. Nevertheless, approximately 30% of users who use CAs solely for practical purposes still perceive their CA as an alter ego.

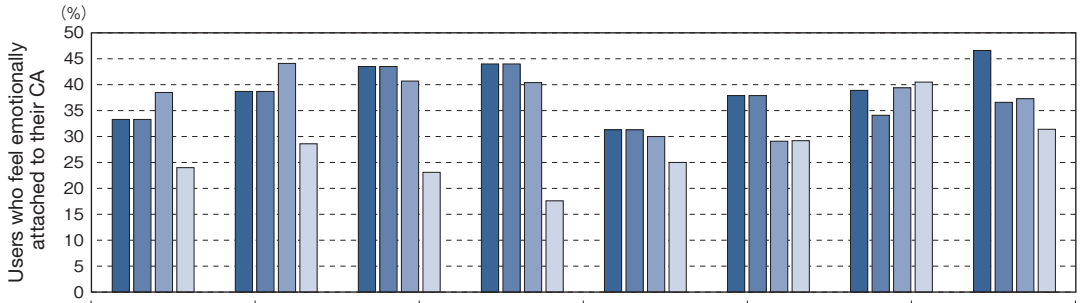
54. Narihara, S. (2022). "Architecture and Law of Metaverse: Platform of World Creation and its Governance," *Nextcom 52*, pp24-32
55. Ishii, K. (2023). "Self-Image Formation and Identity Rights: Focusing on Avatars in the Metaverse," *Journal of Information and Communication Policy, 7*(1)
https://www.soumu.go.jp/main_content/000889620.pdf



	Entertainment	Education	Social Interaction	Business	Healthcare	Tourism	Real Estate	Shopping
Japan	48.1%	40.3%	53.5%	52.1%	52.2%	48.6%	38.9%	46.6%
South Korea	41.1%	42.0%	45.0%	46.4%	52.3%	41.8%	34.1%	36.6%
United States	36.2%	32.6%	39.2%	44.3%	36.6%	40.9%	39.4%	37.3%
Germany	37.3%	28.3%	41.8%	39.5%	36.4%	33.0%	40.5%	31.4%

n=767, 871, 925, 885

Figure 6.1 Percentage of users who feel emotionally attached to their CA (by country)

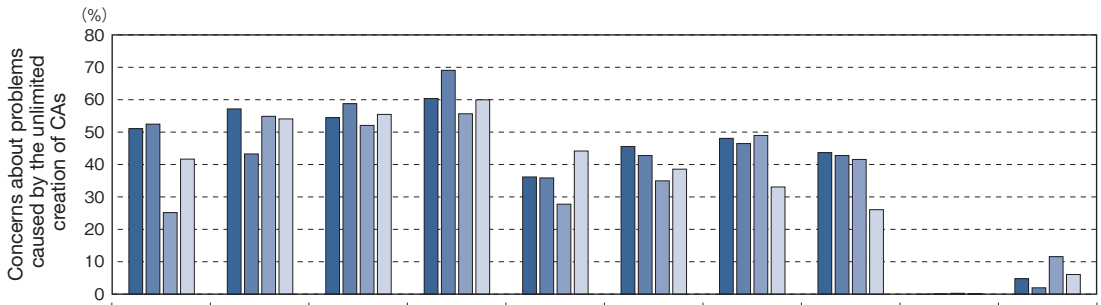


	Education	Business	Healthcare	Tourism	Real Estate	Shopping
Japan	33.3%	38.7%	43.5%	44.0%	31.3%	37.9%
South Korea	33.3%	38.7%	43.5%	44.0%	31.3%	37.9%
United States	38.5%	44.1%	40.7%	40.4%	30.0%	29.1%
Germany	24.0%	28.6%	23.1%	17.6%	25.0%	29.2%

n=767, 871, 925, 885

Figure 6.2 Percentage of users who feel emotionally attached to their CA (by country, excluding entertainment and social interaction use)

The survey asked users whether they perceived identity-related issues by listing several potential problems associated with the unlimited creation of CAs. Although minor differences existed across countries and issue types, approximately half of respondents in each country reported concern about each of the listed problems (Figure 6.3). The proportion of respondents who expressed no concern about their ability to create unlimited CAs was less than 10%, indicating that identity-related issues are indeed recognized by current CA users.



	Spreading rumors or slander about someone anonymously using an avatar	Harassing others by switching between multiple avatars	Spreading false information or disinformation using multiple avatars	Committing fraud using an avatar	Orchestrating fake praise or staged interactions using two avatars	Creating an avatar that closely resembles someone in order to impersonate them	Changing avatars to repeat the same misconduct after being exposed	Re-registering after account deletion and creating a new avatar to continue misconduct	Other	Not particularly concerned about the ability to create and modify avatars anonymously and without restriction
Japan	51.1%	57.2%	54.5%	60.4%	36.2%	45.6%	48.1%	43.7%	0.0%	4.8%
South Korea	52.5%	43.3%	58.8%	69.1%	35.9%	42.8%	46.5%	42.8%	0.1%	2.0%
United States	25.2%	54.9%	52.1%	55.7%	27.8%	35.0%	49.0%	41.6%	0.3%	11.6%
Germany	41.7%	54.1%	55.5%	60.0%	44.2%	38.6%	33.1%	26.1%	0.2%	6.1%

n=767, 871, 925, 885

Figure 6.3 Concerns about problems caused by the unlimited creation of CAs (by country)

6.3. Consideration of methods to ensure identity

This section outlines the current state of affairs as a foundation for considering measures to ensure identity in CA use. To begin, we summarize the existing methods of securing identity on the internet.

Identity verification (i.e., authentication) on the internet can be understood through two concepts: reachability and linkability.[56] Reachability refers to the ability to identify and contact a person in the real world and is essentially equivalent to knowing a person's real name. Linkability refers to the ability to determine whether the person who carried out one online action (X1) is the same person who carried out another action (X2), which can be achieved by assigning a fixed identifier (such as a name or ID) across online activities. These two concepts help classify the three identity systems, as shown in Figure 6.4.

	Reachability	Linkability
Identity	○	○
Pseudonymity	×	○
Anonymity	×	×

Figure 6.4 Classification of identity authentication methods on the Internet

56. Orita, A. (2012). "Social Media and Anonymity," *Journal of Artificial Intelligence, 27*(1), pp59-66 https://doi.org/10.11517/jjsai.27.1_59

The simultaneous use of real names provides both reachability and linkability. A pseudonym allows linkability by assigning a consistent identifier (ID or screen name) across actions, enabling a coherent identity to be maintained online. In contrast, anonymity breaks the connection between actions, so observers cannot tell who performed each one.[57]

Based on this framework, the most straightforward and robust countermeasure is to mandate real-name registration for CAs. Real-name systems can vary in strictness—for example, cases where only the platform operator knows the real identity, or cases where it is disclosed to all users. In any case, once a CA is tied to a real-world individual, identity can be secured even if multiple CAs are created. However, for this method to gain social acceptance, a substantial proportion of metaverse users must be comfortable using their real names.

To assess the current situation, a survey was conducted among entertainment users, the largest CA user group, asking whether their main communication partners were metaverse operators or other users and whether those partners knew their real names.

The results show that in all four countries, the majority of users communicated without knowing the real names of their partners (i.e., the respondents). This tendency was particularly strong in Japan, where 43.3% said that their primary partner was another user whose real name they did not know, while only 12.6% communicated with someone whose real name they knew, indicating that approximately 20% of interactions involved real-name recognition. A similar pattern was observed in other countries: approximately 30% in South Korea, and approximately 40% in the United States and Germany (Figure 6.5). Moreover, some respondents may have known each other's names in real life (e.g., pre-existing friends), meaning that the percentage of names disclosed within the metaverse is likely even lower. Therefore, implementing a real-name system is currently unrealistic.

57. In practice, some confusion arises because intermediate cases are also possible. The strongest form of anonymity occurs when no ID exists at all. For example, 2-channel bulletin boards do not display IDs, making each post completely unlinkable and impossible to attribute to a specific author. By contrast, sites such as Yahoo News and review platforms assign IDs, so following the link enables one to see that a series of actions were performed by the same person. However, if the ID can be obtained or replicated in multiple ways, impersonation or fabrication of actions becomes possible. To prevent this, limiting users to a single account is necessary. Achieving this requires verifying the user's identity through a personal number, cell phone, or similar method, and using the real name at the management level.

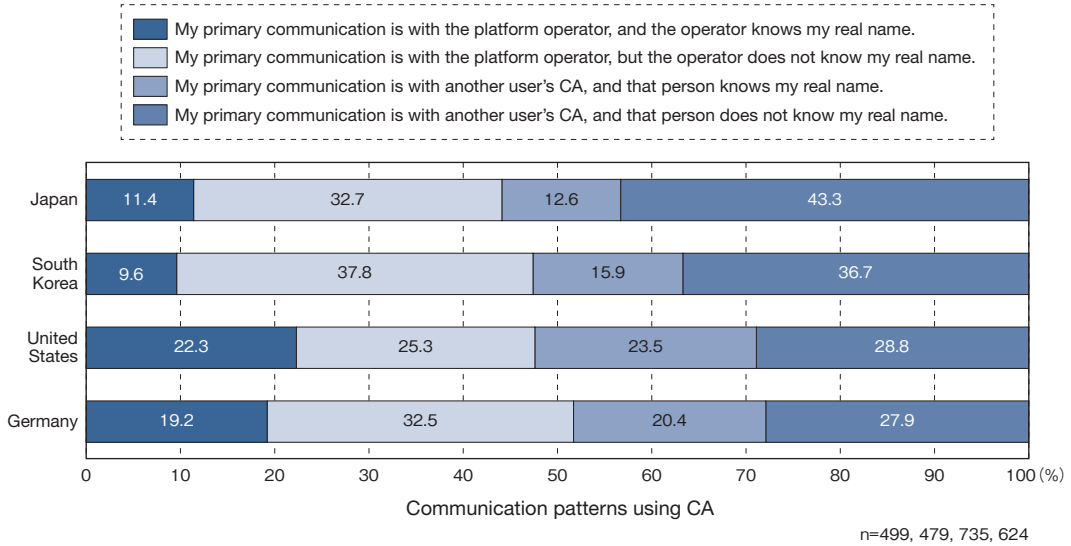
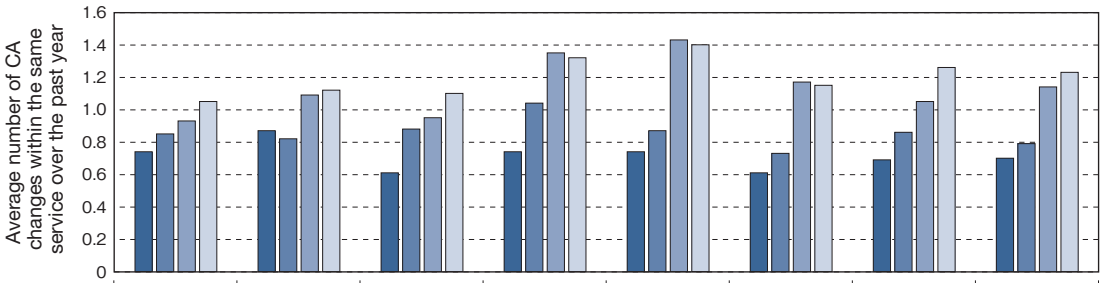


Figure 6.5 Communication patterns using CAs (entertainment sector, by country)

A second possible countermeasure is to restrict changes to the CA after its initial creation. If CAs cannot be altered, much like physical bodies in the real world, perfect linkability could be achieved, effectively resolving identity issues.

To assess the feasibility of this approach, we surveyed the frequency with which users changed their CAs within the same service over the past year. The results show that even in Japan, users changed their CAs approximately 0.7 times on average, while in the United States and Germany, users changed their CAs more than once on average (Figure 6.6). This suggests that many people enjoy modifying their CA appearance in the metaverse. Given this behavior, a rule prohibiting CA changes is likely to face strong resistance from users, making this approach impractical.



	Entertainment	Education	Social Interaction	Business	Healthcare	Tourism	Real Estate	Shopping
Japan	0.74	0.87	0.61	0.74	0.74	0.61	0.69	0.70
South Korea	0.85	0.82	0.88	1.04	0.87	0.73	0.86	0.79
United States	0.93	1.09	0.95	1.35	1.43	1.17	1.05	1.14
Germany	1.05	1.12	1.10	1.32	1.40	1.15	1.26	1.23

n=767, 871, 925, 885

Figure 6.6 Average number of CA changes within the same service over the past year (by country)

6.4. Preferred measures

Building on the discussion in Section 6.3, we consider desirable measures to ensure identity in the metaverse by gradually increasing restrictions from the current situation. Five possible measures are listed below in order of increasing restriction, with explanations provided for each:

1. The first measure is to maintain the current environment, in which users are free to create and modify their CA without restrictions.

2. The second measure involves real-name verification, which is visible only to the platform operator. When a user creates an account, their identity is verified using personal information, such as a national ID number or mobile phone number. This ensures "reachability" from the operator's perspective and helps prevent issues such as banned users creating new accounts or individuals operating multiple accounts to orchestrate deceptive behavior. Importantly, the user's real name is known only to the operator and is not disclosed to other users, thereby preserving anonymity at the user level.

3. The third measure also uses real-name verification visible only to the operator. In this case, while CA changes are allowed, the system retains a visible change history. For example, when a part of the CA is clicked, all previous versions can be displayed. While "linkability" usually refers to static digital activity, this measure extends the concept to the temporal dimension, enabling persistent identity tracking over time. By introducing this change history, users are incentivized to behave consistently within a metaverse. Compared with the second measure, this reduces opportunities for impersonation or orchestrated manipulation.[58]

4. The fourth measure also adopts real-name verification visible only to the operator but prohibits any changes to the CA once created. Even when the history is visible, tracing actions linked to previous versions remains difficult. Fixing the CA from the beginning makes it functionally equivalent to one's physical face in the real world, effectively deterring impersonation and abuse.

5. Finally, the most restrictive option is real-name disclosure at the user level. This means that the user's real name is always visible or can appear when clicking on a part of the CA. This ensures robust identity verification; however, it greatly undermines the original appeal of the metaverse—the ability to live in a world different from the real one. Under this measure, because the real name is always visible, other restrictions become unnecessary, and users remain free to create and modify CAs as they wish.

We asked CA users which of these five options they considered most reasonable. The question was phrased as follows:

Q: To prevent misuse of CAs, possible countermeasures include strengthening account verification and restricting the ease of creating or changing CAs. While this would make the metaverse closer to the real world, it may reduce the enjoyment of freely creating and customizing a CA. Please choose the most appropriate measure based on your view of the balance between freedom and security.

(1) Maintain the current situation in which CAs can be freely created and modied.

58. In a situation where CAs can be changed at will, we considered disclosing change history as a way to prevent impersonation and abuse, but other methods may also be possible. However, no clearly better approach comes to mind. For example, management could attempt to crack down on identity theft and abuse, but the costs would be substantial, and enforcement would be difficult because actions such as backbiting and stalking are not immediately illegal. Additionally, requiring users to remember long strings of numbers or symbols is impractical.

(2) Authenticate users using a phone number or My Number, limit to one account per person. Real names are not disclosed. However, CAs can be freely modied.

(3) Authenticate users using a phone number or My Number, limit to one account per person. Real names are not disclosed. CAs can be modied freely, but the change history will be made public.

(4) Authenticate users using a phone number or My Number, limit to one account per person. Real names are not disclosed. CAs cannot be modied.

(5) Both accounts and CAs can be freely created and modied, but the user's real name will be disclosed.

(6) Other (free description)

(7) I don't know.

The results are presented in Figure 6.7. Options at both extremes—(1) full freedom and (5) user-level real-name systems—received low support, with only about 8–17% choosing (1). This suggests that users across countries are aware of potential issues related to CA identity.

Support for real-name disclosure at the user level (5) was consistently low, around 5% in every country. Even when full freedom to create and change CAs is allowed, users overwhelmingly reject real-name systems. This indicates that users value the metaverse precisely because it allows separation from their real-world identity. Thus, a real-name system is not seen as a viable solution.

Support for fixing the CA, as in option (4), was also limited to approximately 12%. This reflects resistance among users to being locked into a single CA, as many consider the ability to change their CA an essential part of the metaverse experience.

The most supported options were (2) and (3), both of which involve real-name verification by the operator while allowing CAs to be changed freely. These options prevent misuse, such as individuals creating multiple accounts to manipulate conversations or banned users returning with new accounts. At the same time, they preserve user freedom regarding CA design, which is preferred by the majority.

However, opinions were split on whether CA change history should be publicly disclosed: support for (2) and (3) was nearly equal, at approximately 30% each. This suggests that the tradeoff between preventing abuse and preserving user freedom leads to different views. Notably, this trend was consistent across all four countries.

Beyond the question of change history, overall national differences in preferences were minimal, indicating that the expressed views reflect a broadly shared perspective among metaverse users worldwide.

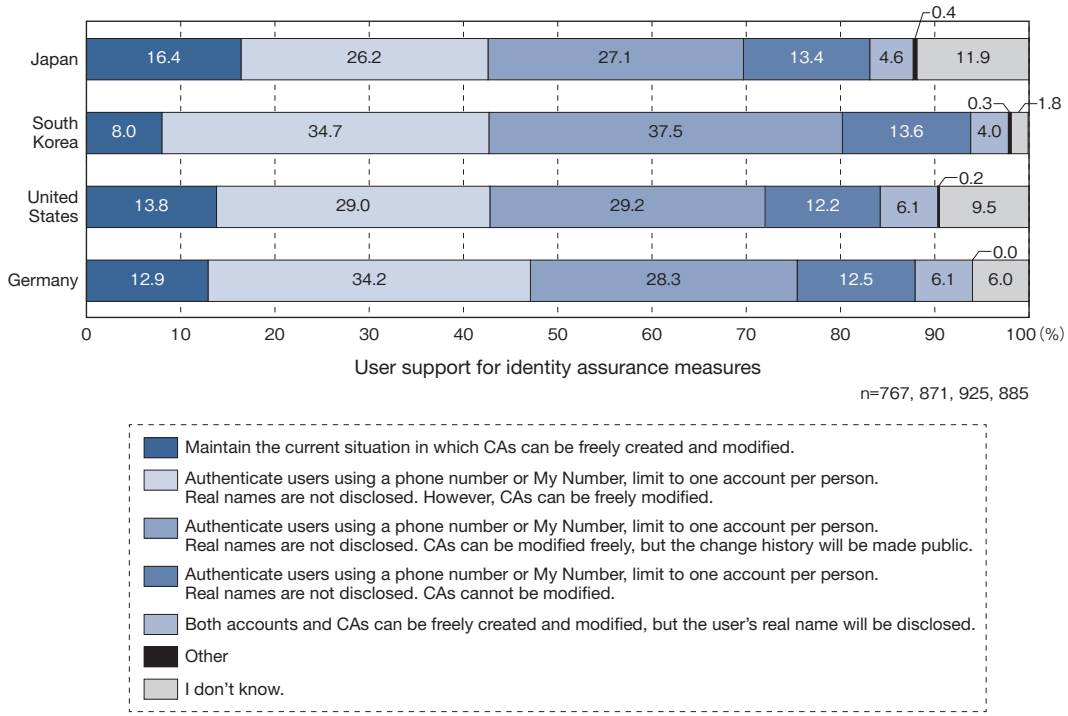


Figure 6.7 User support for identity assurance measures

Based on these results, the key user opinions can be summarized as follows:

i) Users support real-name verification at the operator level (e.g., via mobile phone or national ID) but oppose real-name disclosure at the user level.

ii) Users accept a one-account-per-person policy but believe that CAs should remain changeable.

iii) Users are evenly divided on whether a CA change history should be disclosed publicly.

The third point—whether to disclose the CA change history—essentially represents a fundamental philosophical choice: Is the metaverse a place where people can be reborn repeatedly, or is it a world in which one's personality remains continuous and enduring?

6.5. Determinants of CA regulation

As shown in the previous section, although many users wish to retain the freedom to change their CAs at will, opinions are divided on whether the history of those changes should be made public. The vision of the metaverse itself shifts significantly depending on this point. Disclosing one's history fosters a sense of personal continuity and can reduce the risk of impersonation and misuse. In contrast, if history remains private, users are free to discard their past and reinvent themselves as entirely new personas—an appealing feature for many, but one that increases tolerance for the risks of impersonation and various forms of abuse.

This divergence in opinion—essentially reflecting the type of metaverse people prefer—is a noteworthy

phenomenon likely influenced by a range of factors. To explore this, a regression model was constructed to identify variables correlated with this difference. The following conclusions were drawn:

First, regarding metaverse-related characteristics, users with prior VR experience were less likely to support disclosure of their CA history. In contrast, the frequency of CA use, having changed one's CA within the past year, and overall duration of CA usage did not show significant effects. The lack of effect of CA usage history is particularly notable; whether someone has used a CA for one month or five years does not appear to influence their stance on history disclosure. In other words, opinions on this matter do not converge over time.

Second, regarding respondents' demographic attributes, those with higher income levels tended to be more reluctant to support CA history disclosure. Conversely, women and older individuals were more likely to support disclosure. No significant relationship was found with educational attainment.

6.6. Implications

This section summarizes the implications for the future of the metaverse. The findings of this study suggest that two distinct types of metaverse environments will emerge: Metaverse I and Metaverse II. In both cases, identity verification is performed using systems such as Japan's My Number, and each user is issued a single account with their real name known to the platform operator. Within that framework, users will still be able to recreate their CA multiple times.

Metaverse I retains a history of CAs, meaning that even if users change their CA, their personalities within the metaverse remain consistent. In contrast, Metaverse II does not retain any history, allowing users to be reborn as entirely different individuals each time they change their CA. The preferred environment depends on each user, and these preferences give rise to fundamentally different forms of social order.

In Metaverse I, where people carry their personal histories, users are less inclined to behave recklessly, resulting in a stable and calm environment akin to the real world. Because users are aware of each other's past identities, the space resembles a private club where acquaintances gather—a pastoral, village-like setting.

Metaverse II, in contrast, offers a world unbound by history, where individuals can transform into anything they wish. This creates a thrilling and unpredictable environment, akin to a mysterious tavern in a chaotic urban setting filled with unknown and enigmatic figures.

Both types of metaverse have their own appeals and are likely to attract users drawn to their respective characteristics.

7

Copyright system in the metaverse – copyright exchange (international comparison)

In today's society, where the internet is widespread, concern is growing that the current copyright system is increasingly misaligned with actual practices. Numerous creative works that technically violate copyright laws are available on the internet. However, arguing that eliminating all of these violations would be socially desirable is difficult. This is because the abundance of such uses, including derivative works that fall outside the scope of current legal protection, has contributed in many ways to the vibrancy of cultural activity. To address this mismatch, various proposals have been made to revise copyright systems. However, because of deeply rooted historical constraints, meaningful reforms have progressed slowly.

In contrast, the metaverse, as a digital realm distinct from the real world, offers a unique opportunity to design new systems unconstrained by such historical baggage. In this context, this chapter explores what an ideal copyright system might look like in a society where the internet is ubiquitous and considers the implementation of a copyright exchange within the metaverse as a potential solution. Such an exchange would enable a broad spectrum of applications, ranging from traditional commercial uses requiring permission to free, non-commercial applications.

This chapter investigates whether such a copyright exchange system would be acceptable to metaverse users.

7.1. Nature of the issue

7.1.1. Issues with the copyright system in the internet era

Extensive commentary highlights the inconsistencies of copyright systems in the internet era. For example, the book Toward a Flexible Copyright System[59] compiles arguments from legal scholars who recognize these issues. The term "flexible" reflects the idea that copyright law should adapt more effectively to the realities of the internet. Numerous similar critiques appear in the literature.[60] [61]

The inconsistencies stem from the separation of media and work, as well as from the transformation of society into one in which anyone can be a creator. Before the internet era, works were invariably tied to a

59. Nakayama, N., & Kaneko, T. (2017). *Towards a Flexible Copyright System: The Role of Content and Copyright Law.* Shinzansha.
60. Tamura, Y. (2014). "Reformulation Theory of Japanese Copyright Law.—Structural Challenges in the Age of Digitalization and the Internet Era." *Journal of Intellectual Property Law and Policy, 44,* 25-140.
61. Noguchi, Y. (2010). *Copyright in the Digital Age.* Chikumashobo.

physical medium or distribution network: music came on CDs, novels were printed as books, games were distributed on ROMs or CDs, television programs aired on broadcast networks, and movies were shown in theaters.

When someone created a novel or composed music, they could not distribute it without a publisher or record label producing it in physical form. Because the production and promotion of physical media involved significant costs, publishers and labels had to select creators who justified the investment. Creative activity was thus largely confined to a small number of professionals, while the rest of society primarily consumed their work. Within this context, copyright law regulated the rights of professional creators and functioned as an "industry law" governing interactions within the creative sector.[62] Under these conditions, the rule that all uses of a work required permission from the rights holder was logical, as negotiations occurred only among a limited number of professionals or their agents.

Digitization and the spread of the internet have radically altered this landscape. When works were bound to physical media, issues could be addressed using analogies to ownership rights. Once decoupled from physical media, however, works exist as pure digital data that can be replicated and distributed at negligible cost.

As a result, both professionals and the general public can now engage in creation and dissemination. In many cases, these new works are modifications or adaptations of existing ones, which would require permission from the rights holder under copyright law. However, because the number of creators has exploded and most are not professionals, obtaining permission has become impractical. Consequently, unauthorized use has become widespread online. For instance, a large proportion of images and videos circulating on platforms such as TikTok or X are uploaded without permission and are technically illegal. Yet, if all of these were removed as illegal, expressive activity on the internet would be severely curtailed, rendering the online world barren and stifling cultural expression. Currently, this creates a fragile situation in which unauthorized use is implicitly tolerated because rights holders do not enforce their rights. This problem has been widely recognized by copyright scholars. For example, Nobuhiro Nakayama, a leading copyright scholar in Japan, observes:

"In an era when everyone copies, modifies, and transmits creative works, wouldn't clinging to the traditional dogma of property law in the copyright system become detrimental to information use?"

Nakayama also laments that the current copyright system is ill-suited to this new reality, stating that copyright law has entered a "melancholy era."[63]

7.1.2. Challenges of the copyright system in the digital age

Current copyright systems are not well suited to the realities of the internet era. What should be done? The root of the problem is that the traditional method—where a small number of professionals obtain usage permission through contractual agreements—becomes infeasible when the entire population can be creators. In this context, the transaction costs are too high to facilitate widespread use. For example, suppose an amateur and unknown creator produces a collection of illustrations or a short animated work and publishes it online. That creator might want to sell the work at a low price (e.g., JPY 100), or may prefer that others use all or

62. Nakayama, N. (2007). *Copyright Law.* Yuhikaku.
63. Nakayama, N. (2007). *Copyright Law.* Yuhikaku.

part of the work, or even screenshots of it, free of charge and with attribution to gain recognition. However, current systems rarely fulfill these requirements. Users who wish to use the work must expend significant effort to locate the creator, negotiate terms, and obtain permission. Consequently, the only practical option is often to make unauthorized use of the work, fully aware that it is illegal.

To resolve this unhealthy state of affairs, transaction costs must be drastically reduced. One historically established method of lowering transaction costs is the creation of exchanges. Many examples exist, including stock, bond, grain, and crude oil exchanges. Local morning markets, where nearby farmers sell their crops, can also be viewed as a form of exchange. A similar model can be applied to copyright, in which a copyright exchange reduces transaction costs.[64]

The proposed copyright exchange is envisioned as an organization with the following functions:[65]

(1) Creators register their works with the exchange and specify usage conditions. These conditions may include options such as: "All uses require individual permission," "Usable upon payment of a fixed fee (X yen)," "Usable for non-commercial purposes," or "Usable without restriction."

(2) Users who wish to use a work can search for it through the exchange. The exchange then displays the usage conditions. If payment is required, the user pays through the exchange, which mediates the transaction and issues a usage license. Even when no payment is needed, the user receives a notice such as "Usable for non-commercial purposes," thereby obtaining legal assurance that their usage does not constitute a violation.

(3) Works not registered with the exchange are allowed for a predetermined low fee held in reserve. If the creator comes forward later, the reserved amount is paid to them, addressing the issue of orphan works.

The main benefit of this exchange is that it allows amateur creators to transact their works. Only a small fraction of amateur creators can successfully produce commercial work. Most are at a stage where they want their work to be used, receive feedback, or promote their names. This exchange meets these creators' needs. On the user side, the exchange provides assurance that usage is lawful, enabling more active engagement with creative works.

In function (1), the system resembles Creative Commons in that it clearly states usage conditions. However, two key differences emerge. First, as seen in function (2), the exchange not only issues licenses but also mediates payments, supporting microtransactions (e.g., JPY 100) and reducing usage disputes. Second, in function (3), unregistered works are automatically considered usable for predetermined fees. Thus, the

64. Another approach to reducing transaction costs is for rights holders to establish a comprehensive management organization that enters into contracts with platforms. In the music field, for example, the Japanese Society for Rights of Authors, Composers, and Publishers (JASRAC) has signed blanket agreements with platforms such as YouTube and Niconico. Under these agreements, the platforms pay copyright fees to JASRAC on behalf of users, allowing users to distribute videos containing music without obtaining individual permissions. From the user's perspective, this effectively eliminates transaction costs, which contributed to the popularity of user-generated content such as "tried singing" and "tried performing" videos on YouTube and Niconico. This case illustrates how reducing transaction costs can significantly stimulate cultural activity. However, this method of creating a management organization does not function well outside the music field. Even in music, such organizations can sometimes restrict usage, which presents a major drawback. Therefore, this approach is not highly recommended.

65. Tanaka, T. (2017). "Boku no kangaeruka seisaku kenkyou seido: shinin shugi no kankei [My Idea of a New Formalism]." *GLOCOM Discussion Paper Series, 17-1*.
https://www.glocom.ac.jp/wp-content/uploads/2017/01/GLOCOMDISCUSSIONPAPER_No3_2017No.1.pdf

system resembles a formal registration system (formality-based system). Under current copyright law, which follows a non-formality-based principle, all rights are granted automatically upon creation. In contrast, under this exchange system, if a work is not registered, anyone can use it by paying a set fee, creating strong incentives for registration. Furthermore, by adopting a formality-based system, the issue of orphan works is addressed.

Implementing such a copyright exchange in the real world would be difficult. However, within the metaverse, such a system can be realized through the authority of the platform operator. If platform operators stipulate in their terms of service that digital assets, such as clothing and goods created in the metaverse, must be transacted according to the rules of the copyright exchange, this framework can serve as the governing system.

Some may question whether adopting a formality-based system within the metaverse is acceptable, while the real world follows a non-formality-based approach. This depends on whether local rules within the metaverse for copyright can be recognized; currently, no established legal precedent exists. However, if the rules are clearly stated at the outset and users agree to join the metaverse, a certain degree of legal discretion is likely to be allowed.[66] This is because the exchange targets only digital assets within the metaverse, and their usage is confined to that space. Therefore, adopting a formality-based system is unlikely to result in significant legal disadvantages.

Note that while this copyright exchange system does not conflict with the frequently discussed Non-Fungible Token (NFT) solution to metaverse copyright issues, it represents a fundamentally different conceptual approach. NFTs use blockchain technology to identify the owners of digital assets. Because copies do not carry ownership rights, NFTs provide pseudo-property rights to digital goods. They are already being applied to digital artworks and are under investigation from various perspectives. NFTs are also discussed in the context of copyright systems in metaverses.[67] [68] Some have noted that NFTs, by tracking transaction histories, can be effective in addressing the orphan work problem.[69] However, legal concerns remain regarding NFTs transferring rights to assets that have not yet been acquired.[70]

By assigning ownership rights to digital assets, similar to physical goods, NFTs eliminate some of the advantages that arise from separating content from physical media. The cultural vibrancy seen on the internet exists because digital content can be copied and distributed freely. Reinstating ownership rights could reduce openness, potentially reversing these benefits. Moreover, the vast number of amateur works have little market value, making NFT protection largely meaningless. Even if lacking market value, amateur work can still hold significant cultural importance, and future talent may emerge from it. Therefore, society must support such creative activities. The copyright exchange system is designed to promote and encourage amateur

66. Sawada, N. (2023). *Law and the Metaverse ③ [Explanation from an intellectual property rights perspective!]*. https://nao-lawoffice.jp/venture-startup/platform/metaverse-titekizaisanken.php
67. Dong, Y., & Wang, C. (2023). *Copyright protection on NFT digital works in the Metaverse.* https://doi.org/10.1051/sands/2023013
68. Pandey, A., & Dubey, S. (2024). "COPYRIGHT LAW AND VIRTUAL REALITY: EMERGING LEGAL ISSUES." *Indian Journal of Law and Society, II*(2), 38-49. https://doi.org/10.5281/zenodo.11180263
69. Goldenfein, J., & Hunter, D. (2017). Blockchains, Orphan Works, and the Public Domain. *Colum. jl & arts, 41*(1). https://doi.org/10.7916/jla.v41i1.2037
70. Lim, E. C. (2024). "Finding nemo: Digital art, tokenised assets, virtual property and the right of communication in copyright law." *Property, 27*(1), 69-87. https://doi.org/10.1111/jwip.12290

cultural activity. While high-value digital artwork should indeed be protected by NFTs, a system such as the copyright exchange is far more suitable for a wide array of general users and their creative endeavors.

7.2. Will metaverse users accept a copyright exchange?

7.2.1. Survey overview and current status

To examine whether such an exchange would be accepted by metaverse users, we presented the concept of a copyright exchange to current users and surveyed their willingness to use it. The survey was conducted in April 2024 by MyVoice Communications, Inc., targeting users from four countries who had been screened for prior metaverse experience. Participants included those who currently use the metaverse regularly or had done so in the past. The sample comprised 889 respondents from Japan, 172 from South Korea, 300 from the United States, and 300 from Germany. Individuals who had used the metaverse only once or twice were excluded, as we judged that forming opinions about copyright in the metaverse requires at least some experience in acquiring or modifying digital goods.

In terms of gender distribution, the ratio was approximately equal between men and women in all countries except Japan, where men accounted for 60%. Regarding age, while respondents in other countries were broadly distributed across all generations, Japan showed a clear concentration among younger users in their 20s to 40s (Figure 7.1). Moreover, respondents in their 20s to 40s accounted for 50% of respondents in the United States and Germany, 60% in South Korea, and 80% in Japan. Conversely, whereas users aged 50 years and above comprised over 40% of respondents in the other three countries, they comprised only 20% in Japan (Figure 7.2).

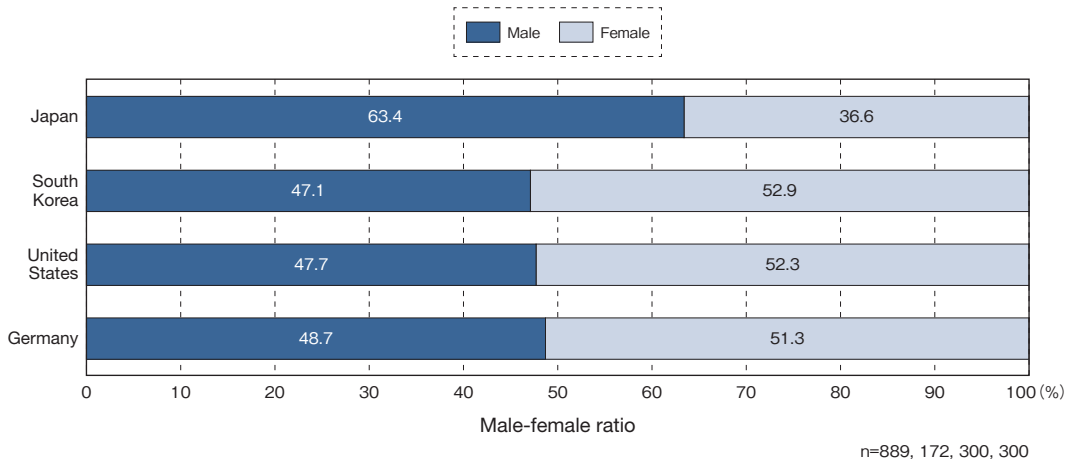


Figure 7.1 Gender composition of survey respondents

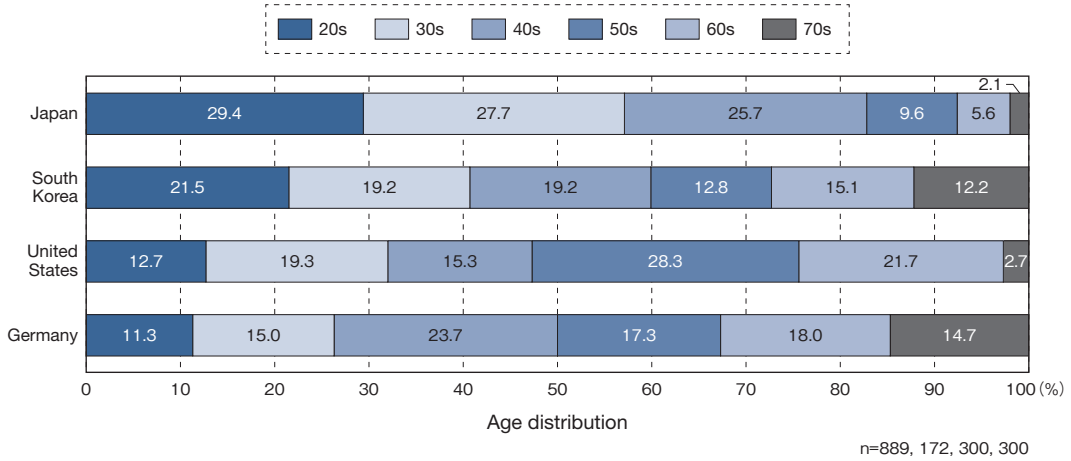


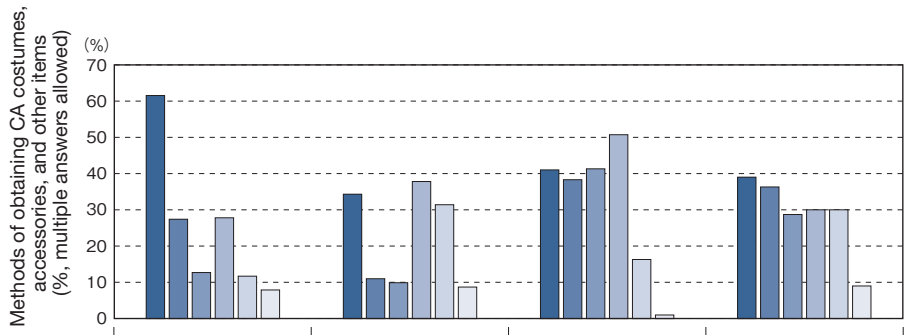
Figure 7.2 Age composition of survey respondents

7.2.2. Current status and latent demand

First, we asked how users obtained items such as CA clothing or accessories within the metaverse, providing five response options and allowing multiple selections.

Overall, all five acquisition methods were used to some extent. The most commonly reported method was "selecting from items prepared by the metaverse operator," with approximately 40% of users indicating this. This method was especially dominant in Japan, where 62% of users reported using it. The next most common method was "purchasing from shops within the metaverse," used by about 30% of users and reaching as high as 51% in the United States. Options 2 and 3, "modifying items oneself" and "having a friend modify items," were more prevalent in the United States and Germany, with about 30% of respondents selecting them. South Korea showed notably lower levels of customization (Figure 7.3).

Finally, the fifth option, "using items found on the internet," was selected by around 30% of respondents in South Korea and Germany, and slightly over 10% in Japan and the United States. Among these five methods, this option raises the greatest copyright concerns. Notably, although users chose it least often overall, 10%–30% still reported using it.

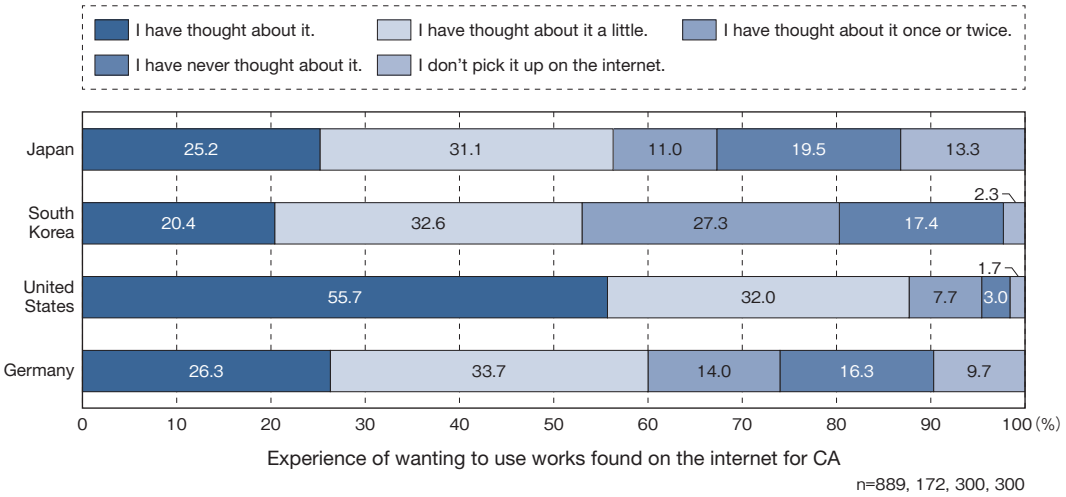


	Japan	South Korea	United States	Germany
Selected from items provided by the operating company	61.5%	34.3%	41.0%	39.0%
Made by myself	27.4%	11.0%	38.3%	36.3%
Made by a friend	12.7%	9.9%	41.3%	28.7%
Purchased from a store in the metaverse	27.8%	37.8%	50.7%	30.0%
Found online	11.7%	31.4%	16.3%	30.0%
Others	7.9%	8.7%	1.0%	9.0%

n=889, 172, 300, 300

Figure 7.3 Methods of acquiring avatar items

Notably, this 10–30% likely reflects underreporting, as users are aware that this constitutes a copyright violation. When asked whether they had ever wanted to use something found online for their metaverse avatar, more than 50% answered affirmatively ("I have thought so" or "I have somewhat thought so") (Figure 7.4). In particular, the United States showed an exceptionally high potential demand, with nearly 90% expressing such interest. Because materials found on the internet cannot be legally used without permission under the current system, this indicates the existence of a large latent demand that could be served by a copyright exchange.



n=889, 172, 300, 300

Figure 7.4 Experience of wanting to use internet-found items for metaverse CAs

To confirm whether this latent demand translates into support for a copyright exchange as a solution, we explained the concept of such an exchange and asked users about their willingness to use it. Responses were collected on a five-point scale: 1) "I would like to use it," 2) "I would somewhat like to use it," 3) "I would not really like to use it," 4) "I would not like to use it," and 5) "I don't know."

The explanatory prompt was as follows:

"When using items such as clothing or accessories for a CA, permission from the copyright holder is required. However, obtaining this permission is cumbersome. Therefore, we propose a copyright exchange system that enables registration and payment processes.

1. Creators register their work on the exchange website and specify the usage conditions. For example, "X yen for commercial use," "Y yen for personal use," or "free for non-commercial use."

2. Users who wish to use a work search on the site, check the conditions, and pay on the spot. If it says, "free for non-commercial personal use," the work may be used without payment.

3. For unregistered work, usage is permitted for a nominal fee (e.g., JPY 100) held in reserve. If the creator appears later, the accumulated amount is paid.

This system allows creators to earn income and users to work easily. Would you be willing to use this system to obtain permission?"

Results show that more than 60% of respondents expressed willingness to use the exchange ("I would like to use it" or "I would somewhat like to use it") (Figure 7.5). Country-specific breakdowns revealed 60% support in Japan, 70% in Germany, over 80% in South Korea, and nearly 90% in the United States, indicating a high level of potential demand for such a system.

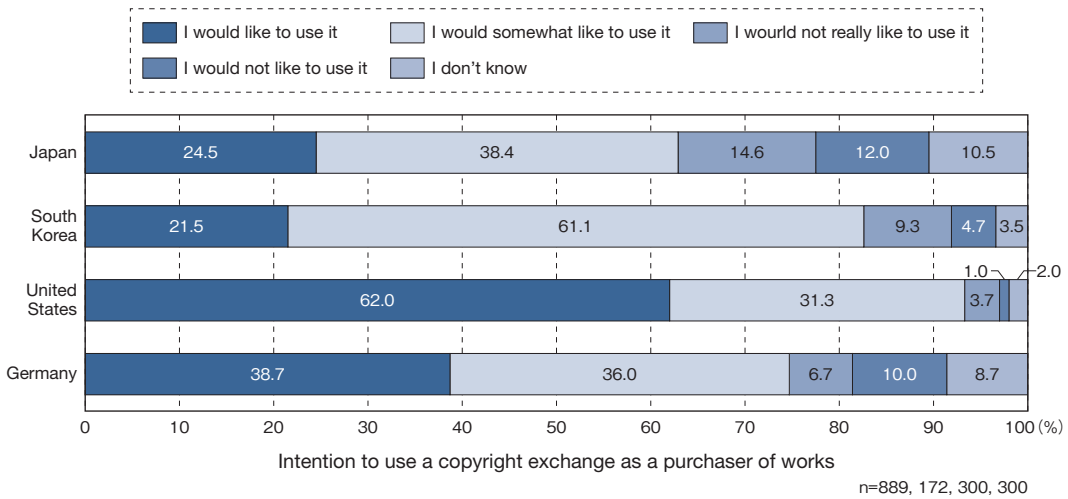


Figure 7.5 Willingness to use a copyright exchange

However, as the survey clearly specified, these responses reflected the perspective of users, not creators, obtaining permission. Because a copyright exchange cannot function without creators registering their

work, we also asked respondents about their support for establishing such a system from that perspective.

Even among respondents who create work, 60–70% supported the idea of establishing a copyright exchange. Support was especially strong in the United States (Figure 7.6).

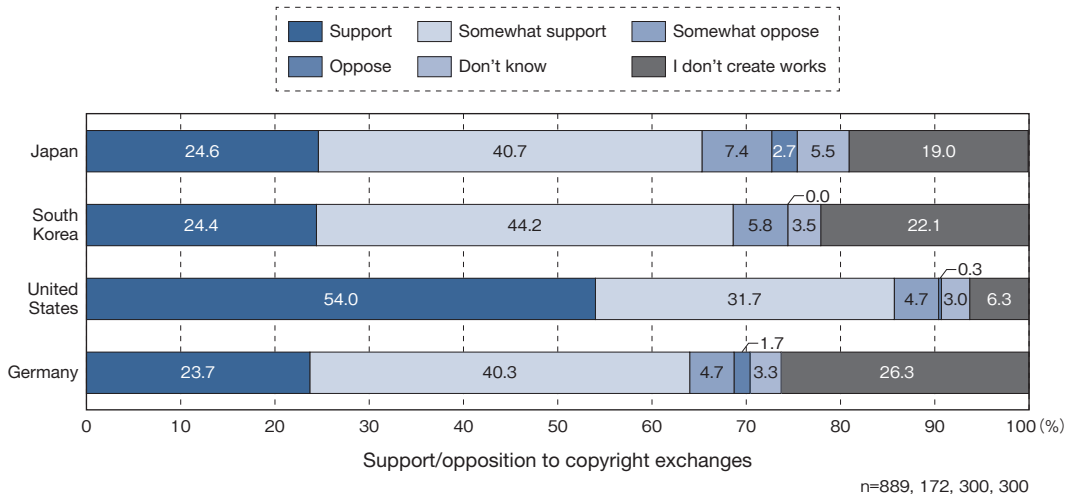


Figure 7.6 Support for and opposition to establishing a copyright exchange

Finally, not all respondents who support the creation of such a system may be willing to register their work. Therefore, we asked those who create work whether they would be willing to register with the exchange. Results again showed high receptivity, with 70–90% of creator respondents answering, "I would like to register" or "I would somewhat like to register." The United States again stood out as particularly enthusiastic (Figure 7.7).

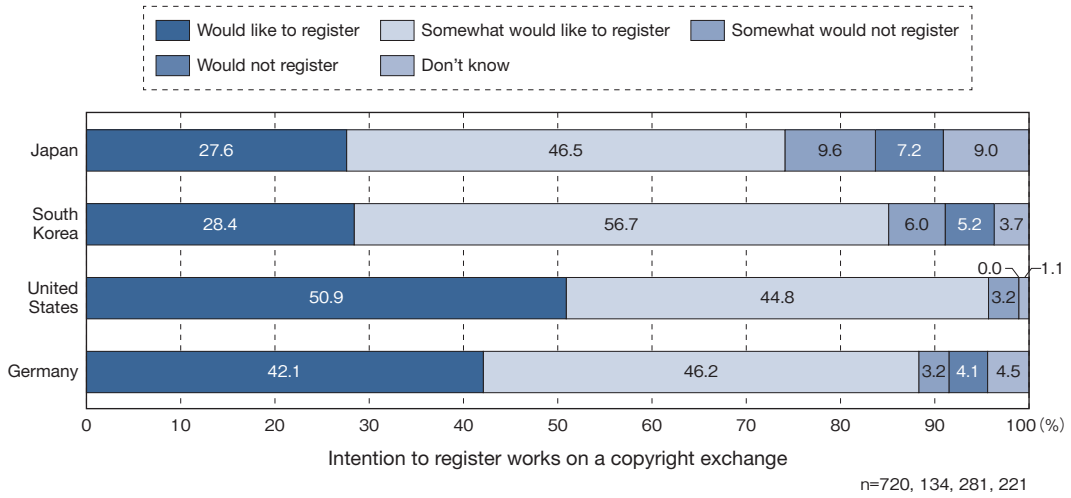


Figure 7.7 Willingness to register works with a copyright exchange

7.2.3. Examination of reliability of results

The previous section revealed that demand for a copyright exchange is high from the perspectives of both users and creators of work. However, the initial explanation of copyright exchange, which served as the premise for the subsequent series of questions, is unusually long for surveys. Unlike face-to-face surveys, online panel surveys cannot confirm whether respondents have read a question, raising the possibility that some respondents may have answered carelessly without reading it. This issue is examined in detail in this section. Although direct verification is difficult, we present four pieces of circumstantial evidence suggesting that respondents did read the explanatory text before answering.

First, the response options included a "Don't know" choice, allowing those who found the text too difficult or could not grasp the purpose of the question to select it. As shown in Figure 7.5, less than 10% of respondents chose "Don't know."

Second, the intention to use a copyright exchange was particularly high in the United States, consistent with previous questions. In Figure 7.5, 62% of U.S. respondents indicated they would like to use a copyright exchange, a conspicuously high figure, and in Figure 7.4, 90% of U.S. respondents reported that they had previously "wanted to use something found on the internet in the metaverse," also a notably high proportion. This consistent pattern, in which the United States stands out, is logical: countries with more individuals who wish to use content found online in the metaverse should naturally show higher interest in using a copyright exchange. If respondents had ignored the long explanatory text in Figure 7.5 and answered casually, such internal consistency would have been unlikely.

Third, we examined whether similar results could be obtained if the questionnaire text was shortened. If the outcomes remained consistent despite simplification, this would suggest that respondents understood and considered the explanation. During the screening phase of this study, the same question was asked in a condensed form as follows:

"One reason people use works without obtaining permission is that the permission process is cumbersome. To simplify this, imagine an exchange where works are registered and paid for. Creators register their works and set usage fees. Those who wish to use the works can pay and immediately use them legally. Do you support creating such a system?"

Upon reviewing the results, the first notable point is that the number of respondents selecting "Don't know" was small, implying that the shorter question was read more thoroughly than the longer one. Overall responses were nearly identical to those in Figures 7.5 and 7.6 (see Figure 7.8). In other words, the main results did not change even when the question was shorter and easier to read. Slightly more respondents supported the system in Figure 7.8 than in Figures 7.5 and 7.6, possibly because the shorter question omitted a potential downside of the mechanism—specifically, that unregistered works would be used at a lower price.

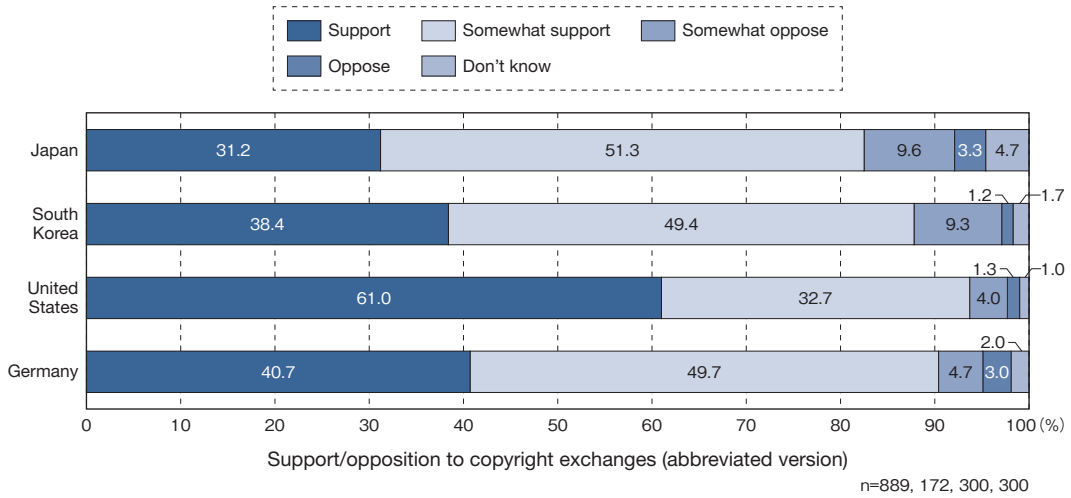


Figure 7.8 Support for and opposition to the copyright exchange (shortened version of question)

Fourth, we posed the same question to non-metaverse users to assess differences between them and metaverse users. Even if non-users of metaverse media wish to use online content for their own creative expression, their level of urgency may be lower than that of metaverse users. Therefore, we expected a lower rate of support for the copyright exchange among non-users and a higher rate of "Don't know" responses. If the results reflect these expectations, they provide additional evidence that respondents read the explanatory text.

Because the question was asked only of non-users only in Japan, the comparison below was limited to Japanese respondents. As anticipated, those who did not use the metaverse (36,871 respondents) were less supportive of the copyright exchange (see Figure 7.9). Combining the responses "Agree" and "Somewhat agree" as indicators of support revealed a 20-percentage-point difference in approval rates between metaverse users and non-users. Furthermore, 27% of metaverse non-users selected "Don't know," again consistent with expectations. These findings support the conclusion that respondents read the explanatory text before answering.

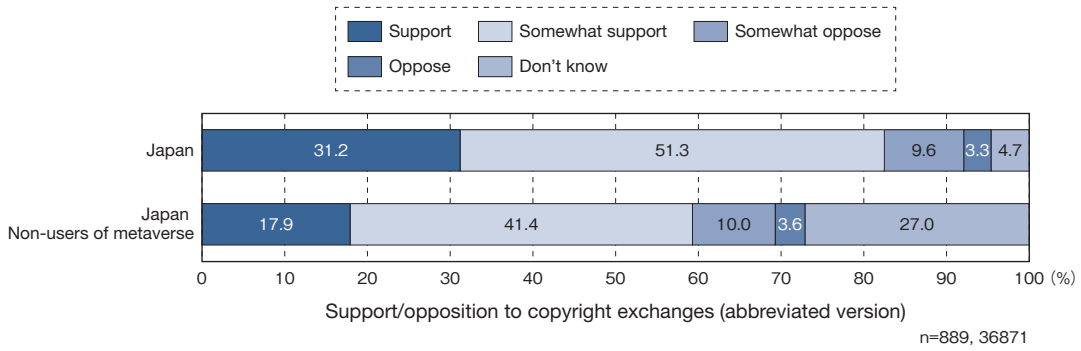


Figure 7.9 Comparison of support/opposition between metaverse users and non-users

These four lines of reasoning were used to assess whether respondents read the explanatory text. Although none provides definitive proof, we can reasonably conclude that most respondents did not answer without reading. If the majority had ignored the explanatory text, explaining the consistency observed across all four phenomena would be difficult.

Notably, apart from the issue of whether respondents read the text, these types of questions are prone to response bias toward agreement. When a problem is first presented and a solution proposed, people tend to respond affirmatively. For example, if one claims that ambulances are being misused by patients with minor conditions and asks whether a small fee should be charged for ambulance use, the number of people who agree will likely increase. Such a bias certainly exists and must be considered when interpreting the results. Those taking a skeptical stance may prefer to discount the results by half. Approximately 60–80% of respondents expressed support for or willingness to use a copyright exchange; even halving this still results in a substantial 30–40%.[71]

7.2.4. Determinants of the use of copyright exchanges

This section analyzes the characteristics of individuals who are likely to use copyright exchanges. The dependent variables are the three types of intention to use a copyright exchange, as shown in Figures 7.5–7.7. Each of the four response options was scored from 1 to 4. The explanatory variables included respondents' demographic attributes, such as gender and age, as well as indicators of metaverse usage, including frequency of use (times per week), duration of each session, and the number of years since they began using the metaverse. In addition, the degree to which respondents expressed a desire to use materials obtained online was measured on a five-point scale. We hypothesized that higher metaverse usage frequency and a stronger intention to use online materials would increase the demand for copyright exchanges. Regression analysis was conducted based on these variables.[72]

The analysis found that greater engagement with the metaverse was associated with a stronger intention to use a copyright exchange. Moreover, the longer the duration of the metaverse experience, the more likely respondents were to support the exchange as creators and to show a willingness to register their work. Because the success of a copyright exchange depends on a large number of creators registering their works, this result is particularly important. Unlike usage frequency or session length, years of experience increased steadily over time, suggesting that more creators will participate in the copyright exchange over time. This can be interpreted as a factor that promotes the adoption of exchanges.[73]

The analysis revealed that individuals with a stronger desire to use materials obtained online were sig-

71. The 20% difference between metaverse users and non-users shown in Figure 7.9 does not need to be discounted. The bias whereby people tend to agree with proposed solutions after problems are pointed out should apply equally to both metaverse users and non-users. Therefore, this 20% difference represents a genuine group of supporters unaffected by such bias. In other words, at least 20% of metaverse users support the solution regardless of bias. Using this as a baseline and assuming that half of the remaining respondents are actual supporters, we subtract the base 20% from the overall 60–80% agreement rate, leaving 40–60%. Taking half of this yields 20–30%, which, when added to the base 20%, results in an estimated 40–50% of genuine supporters.

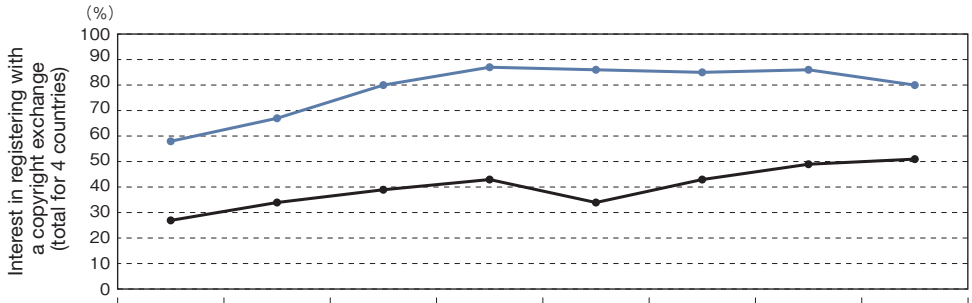
72. Although the dependent variable consists of only four categories and an ordinal logistic regression would therefore be more appropriate, we report the results of a standardized regression here to allow comparison of the magnitude of the coefficients. Notably, running an ordinal logistic regression on the original four categories produces qualitatively the same results in terms of which variables are statistically significant.

73. Of course, when the metaverse experiences rapid expansion, the number of users who do not register their works with the exchange may temporarily increase, as many of these users will be new. However, as long as the overall user base continues to grow at a steady rate, those who eventually register their works will become the majority.

nificantly more positive about a copyright exchange, with coefficients two to four times larger than those of other variables. A similar trend was observed among creators who would register their work. In other words, the strongest factor driving the intention to use a copyright exchange is the desire to utilize online materials, indicating that many amateur creators rely on such resources.

Regarding demographic attributes, women were generally less inclined to want to use a copyright exchange. Younger individuals were more positive as consumers, while middle-aged and older individuals were more positive as creators.

The relationship between years of experience and willingness to use the exchange system is examined in Figure 7.10, which plots respondents' years of metaverse experience on the horizontal axis and the proportion of those "would like to register" or "somewhat interested in registering" on the vertical axis. The graph shows an upward trend, with willingness increasing over time. Including the "somewhat willing" group, willingness plateaus after one year, suggesting that new users initially uncertain about the system gain a clearer understanding of the metaverse and the necessity of copyright exchange after about a year. As the metaverse user base grows, most are expected to be accepting of a copyright exchange within a year of use, with long-term adoption projected to reach 80 percent.



	Just started	2-3 months	Half a year	1 year	2 years	3 years	4 years	5 years or more
Would like to register + Somewhat interested in registering	58%	67%	80%	87%	86%	85%	86%	80%
Would like to register	27%	34%	39%	43%	34%	43%	49%	51%

n=95, 52, 121, 248, 308, 248, 125, 266

Figure 7.10 Willingness to register with a copyright exchange by years of metaverse experience

7.2.5. Summary and conclusion

This section summarizes the main findings of this study:

(1) In the age of the internet, where ordinary individuals—not just professionals—create and publish works, we propose the concept of a copyright exchange that registers online content and facilitates transactions.

(2) When metaverse users were asked whether they would be willing to use such an exchange, 60%–80% responded positively. This willingness was not limited to using the exchange as consumers; a similar proportion (60%–80%) supported it as creators and expressed a desire to register their own

work.

(3) By country, support was particularly high in the United States, where over 80% of respondents responded positively. In other countries, approval exceeded 60%, indicating broad support.

(4) Creators' willingness to register with an exchange increases with the length of their metaverse experience. After approximately one year, the proportion of supportive users approaches 80%, suggesting a learning process during the first year, after which attitudes stabilize.

(5) Individuals with a high willingness to register are typically those who want to use materials found online within the metaverse. This reflects a desire to create work using online materials as components.

The concept of a copyright exchange was originally proposed not only for the metaverse but also as a system applicable to society at large. However, implementation faces extremely high barriers owing to existing institutional constraints. Within the metaverse, a space where new social systems can be constructed from scratch, such a system can be realized as a local rule, provided the platform operator is willing to implement it. If a copyright exchange functions successfully within the metaverse, it could pave the way for expanding the model beyond virtual spaces into broader society. Conducting this experiment within the metaverse is therefore highly valuable. Moreover, according to this survey, users have shown sufficient support for such systems. The remaining question is whether the operational costs can be justified.

8

Development of the elemental technologies of CAs and their potential

In the previous chapters, we outlined the current state of CA use across various contexts. In this chapter, we begin by briefly tracing the history of communication—one of the key roles of CAs—and the technological progress supporting it, from two perspectives: space and object. For each perspective, we also introduce trends in CA research in relevant fields, including business administration and marketing, focusing on CAs' potential for widespread market adoption.

8.1. Spaces for communication

8.1.1. Historical overview

Widespread adoption of the internet has greatly expanded the possibilities for interpersonal communication. Enabling technologies such as bulletin boards, mailing lists, and chat functions, primarily based on digital networks, spread widely via the internet. In 1997, SixDegrees.com, the world's first social networking site (SNS), was launched. Although pioneering, it did not achieve widespread adoption, and SNSs now considered mainstream appeared only after 2000, including LinkedIn (2003) and Facebook (2004). In Japan, Mixi and GREE were launched in 2004, followed by Mobage Town in 2006.

CAs were adopted to support these communication systems, but their development has been more prominent in gaming than in pure communication. Habitat, developed by Lucasfilm's Games Division and regarded as the original MMO environment, began β-testing in 1986. In this virtual world, users navigated as CAs and stand-ins. Although the service ended quickly, Fujitsu licensed, localized, and launched it in Japan in 1990, marking the country's first CA-based platform.

The spread of the internet, alongside the rise of social networks and online gaming, laid the foundation for text-based and CA-mediated communication, respectively. As each evolved independently, platforms combining both emerged. For example, South Korea's Hangame functions as both a gaming platform and an SNS, enabling communication through CAs. Similarly, in Japan, GREE, Mobage Town, and Mixi integrated gaming and SNS functionalities, with CAs playing a central role. The avatars in online environments, as exemplified by these cases, are fundamentally based on two-dimensional (2D) images.

Similarly, three-dimensional (3D) avatars in online environments also found their foundation for widespread adoption in games. In 1997, Ultima Online allowed users to move 2D-but-3D-feeling CAs for interaction and play. In Japan, Sega released Phantasy Star Online in 2000 as a home console 3D network RPG. Designed for small groups, it still enabled simultaneous online play across Japan and abroad using fully 3D CAs. In MMORPGs with many users, 3D CAs are indispensable.

Second Life, launched in 2003, focused on communication rather than gameplay. Its appeal lies in social interactions and simulated daily life, giving CAs a more significant role as personal surrogates than in traditional games. Second Life experienced a boom before rapidly declining, but similar structures appeared in platforms like Minecraft (2011) and Fortnite (2017), whose popularity continue to grow. These environments are collectively termed metaverses. Ball (2020) proposed that a true metaverse should be persistent, synchronous, unconstrained, economically complete, span the physical and digital realms, be interoperable, and supported by broad contributor participation.

Overall, information technology has expanded communication from face-to-face and analog exchanges to online digital environments. Recently, AR and XR, which overlays the real and virtual, has become a key enabling technology for new communication spaces.

AR originated in the 1960s and began developing more rapidly after the 1990s, driven by specific applications in military and aerospace engineering. In the 2000s, key developments included ARQuake, an AR-enabled version of Quake, and the ARToolkit, developed by Hirokazu Kato at the Nara Institute of Science and Technology. During the 2010s, wearable HMDs such as Google Glass and Microsoft HoloLens were launched. In 2016, Niantic, a Google spinout, released Pokémon GO, an AR/GPS-based game that achieved global popularity. Academic publications in this field stabilized in the mid-2010s and surged again after 2015 (Figure 8.1).

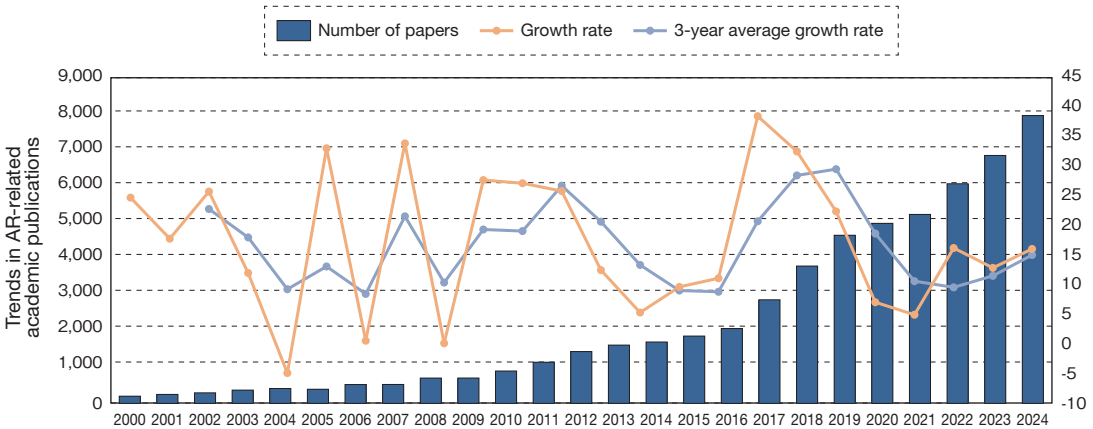


Figure 8.1 Trends in AR-related academic publications (Scopus[74])

In Japan, AR-enhanced communication via live streaming has become common. Face-recognition-based real-time facial processing was introduced in the 2010s, and in 2015, SNOW, an application by the Naver subsidiary, was launched domestically. Today, live-streaming applications typically include real-time facial filtering features. Video uploads and CA-based live broadcasts are popular in Japan. The term "VTuber" became established after Kizuna Ai debuted in 2016. Many VTuber products use motion capture to animate 3D CAs controlled by humans. Even within online communication, diverse modes exist—raw camera videos, filtered feeds, and CG recreation—allowing users to choose the expression style that suits them best.

So far, research has clarified how communication has expanded technologically and in terms of market

74. Scopus, https://www.scopus.com/

development, moving from real-world spaces to digital spaces via the internet and further into AR, which fuses real and digital spaces. Although the starting points may differ—for instance, whether digital elements are incorporated into the real world or real-world elements into digital spaces—the key point is that a wide range of communication methods, no longer categorizable within a simple binary framework, has become widespread. Recognition of CAs as tools for personal expression within digital spaces has increased significantly.

In the future, however, CAs are expected to serve as tools for personal expression in real-world communication spaces mediated through online channels. In digital environments, altering one's mode of self-expression through CAs is relatively easy. Achieving the same diversity in the physical world, where objects exist, is more challenging. Nevertheless, the technologies that make this possible are advancing. For example, projection mapping, introduced around 2000, modifies visual output to match the physical shape of real-world objects. Recent developments in digital signage include sensors that detect environmental information and AI-powered decision-making capabilities, enabling the instantaneous presentation of relevant information. Various hardware technologies, including stretchable displays, are also under research. In 2024, for instance, NHK Science & Technology Research Laboratories unveiled a display using a flexible rubber substrate combined with liquid metal.

As these technological foundations develop, CAs are expected to become increasingly accepted as tools supporting communication in both digital and physical spaces.

8.1.2. Research in the field of business administration

This section introduces research trends in business administration that are relevant for exploring the diffusion of CAs in the market from two perspectives: the digital space and the hybrid space that integrates digital and physical realities (hereinafter referred to as "hybrid space"). These trends were reviewed and compared with research across all fields.

Specifically, we used Scopus to examine research trends in CAs within digital and hybrid spaces. The method was as follows: for the digital space, the primary search term was "metaverse," and for the hybrid space, the primary search terms were "augmented reality" and "extended reality." In both cases, the secondary search term was "avatar." We searched for articles published over the past ten years (2015–2024) targeting titles, abstracts, and keywords. We then counted the number of papers that included both primary and secondary terms. Subsequently, the search was narrowed to the subject area "Business, Management, and Accounting," and the number of relevant papers was counted again.

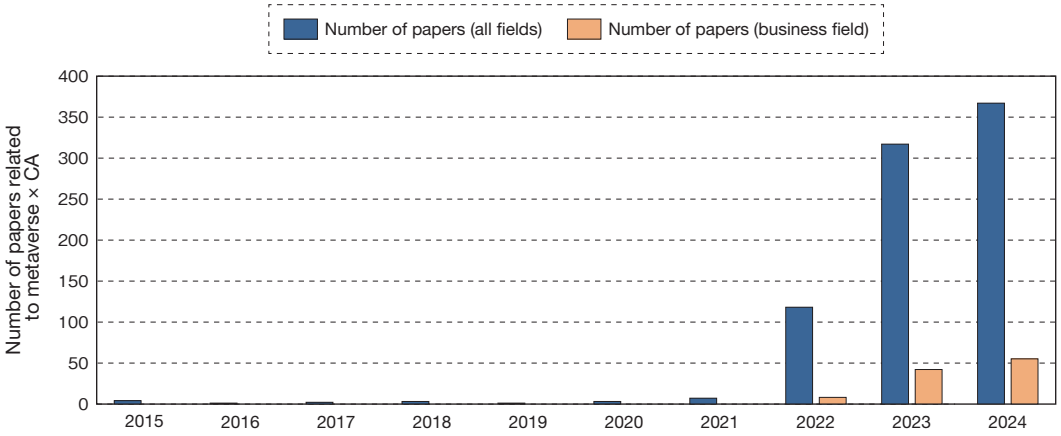


Figure 8.2 Trends in the number of metaverse × CA-related articles

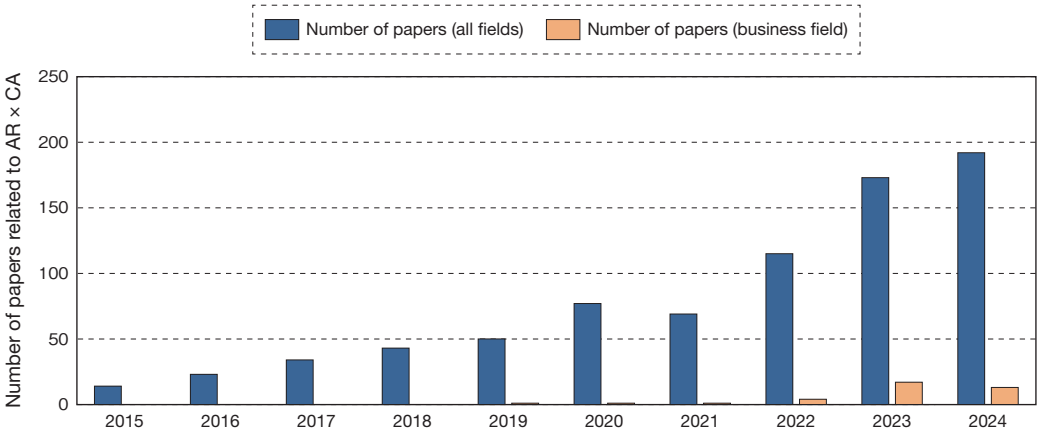


Figure 8.3 Trends in the number of AR × CA-related articles

First, regarding research across all fields, the number of metaverse × CA-related articles increased sharply after 2022, whereas prior to that time, the topic attracted little attention from researchers (Figure 8.2). In contrast, the number of AR × CA-related articles had already gained some focus before 2022 and has been steadily increasing, albeit at a more moderate rate (Figure 8.3). This discrepancy may be attributed to the fact that the concept of the metaverse has not yet firmly taken root among researchers or to the difficulty of using the metaverse as a research subject owing to the lack of widely adopted user platforms.

In the field of business administration, interest in both domains has increased since 2022. However, the number of AR × CA-related articles is projected to decline from 17 in 2023 to 13 in 2024 (Figure 8.3). While this may fall within the margin of sampling error, it also suggests that integrating CAs into AR may present inherent challenges. The number of metaverse × CA-related business articles is 42 in 2023 and 55 in 2024, indicating that research interest is more strongly concentrated on the metaverse. Additionally, when comparing the share of business administration papers to the total number of articles, approximately 15% of metaverse × CA-related papers fall within this field, whereas only about 7% of AR × CA-related papers do.

If the number of publications in business administration is interpreted as a leading indicator of market adoption, services related to the metaverse × CA may be considered advantageous. However, business administration researchers may not yet have recognized the potential applicability of AR. Therefore, continued attention should be paid to this topic in future studies.

8.2. Objects of communication

8.2.1. Historical overview

Just as direct communication between humans extends into digital spaces, the development of information technology has shown that communication counterparts are not limited to other humans. First, humans often communicate with non-human entities. For example, people who keep pets frequently interact with animals such as dogs or cats. Given the similarities between humans and animals, people can relatively easily attribute human-like qualities (anthropomorphize) to animals and, based on this premise, attempt to engage in communication. How, then, have computers—seemingly inorganic at first glance—developed into communication partners for humans over time?

A computer automatically performs complex calculations based on a set of procedures. In this sense, the process in which humans input specific information and the computer returns a calculated result constitutes a form of information exchange and thus contains elements of communication. However, unlike animals, few would consider this interaction anthropomorphic or attribute human-like qualities to it. Although this chapter does not aim to define communication in a strict sense, the history of computers as human communication partners nonetheless reflects how people have endowed them with human-like traits. A prominent example is the Turing Test, which evaluates whether a computer can be mistaken for a human during a conversation with an actual person.

One of the most significant developments in shifting computers from calculation machines to interaction partners is gaming. In the early stages, computers served as players in two-player games, effectively becoming playmates for humans. Games such as checkers and chess were early subjects of AI research. In Japan, notable early examples of games featuring characters that interact with humans include Space Invaders (released by Taito around 1980) and Pac-Man (released by Namco), in which enemy characters are controlled by AI. In this context, computers function as interaction partners capable of selective behaviors under constrained conditions.

In terms of communication partners that resemble humans, ELIZA (developed in 1964) was the first plausible chatbot. It simulated conversations between a patient and a psychotherapist, and its level of sophistication was convincing enough to make participants believe they were interacting with a real human. However, when participants were informed that it was AI, their perceptions changed dramatically, as if the illusion had been broken. The developer, Joseph Weizenbaum, was surprised by this reaction. This distinction between human and AI background knowledge continues to be a focal point of research. Although technological advancements are undoubtedly a key factor in narrowing the gap between AI and humans, researchers have recognized that this alone is insufficient.

From a practical perspective, the role of non-player characters (NPCs) in games has been particularly important in bridging the gap between humans and computers as communication partners. Unlike opponents, NPCs interact with players in a non-hostile manner. Initially, they appeared as characters in role-play-

ing games (RPGs). In Dungeons & Dragons (D&D), released in 1974, NPCs were controlled by humans acting as what we now call "game masters." Starting in 1980, computers began to assume the role of NPCs, which had previously been played by humans. Ultima, released in 1981, was one of the first examples. Influenced by the popularity of RPGs in the United States, Japan saw the release of Dragon Quest in 1986. Since then, improvements in processing power and memory capacity have allowed NPCs to exhibit increasingly complex and human-like behavior. Baldur's Gate, released in 1998 as a spiritual successor to D&D, was explicitly developed to make AI-controlled NPCs feel like real human beings.

Around 2000, public awareness of communication with not only digital characters but also physical robots began to increase. In 1999, Sony released the AIBO, a dog-shaped robot and the world's first consumer-oriented service robot. While AIBO does not support direct verbal communication owing to its dog-like form, it is equipped with various sensors to detect information from the real world and vocal output mechanisms, enabling non-verbal communication. People tend to perceive a certain emotional presence in such robots. Further developments came with Honda's ASIMO, released in 2000, which was capable of autonomous walking. By 2002, it evolved into a robot with intelligent features capable of interpreting human gestures and postures, recognizing faces, calling names, and responding to simple instructions, thus enabling communication.

In the realm of conversational AI, Apple introduced Siri in 2011 as part of the iPhone. In 2014, Eugene, a chatbot developed by a Russian programmer, was reported to be the first to pass the Turing Test. Around the same time, Amazon released Alexa, a smart speaker with voice-interaction capabilities, for home use. In the same year, SoftBank released Pepper, which, although not capable of autonomous walking, featured advanced sensing functions, including facial and emotional recognition. Pepper was also equipped with an emotional expression system capable of conveying joy, anger, sadness, and happiness, and communicated through both voice and tablet interfaces.

Meanwhile, interest in "machine learning," the foundational algorithmic technology behind these functions, has grown rapidly since the mid-2010s (Figure 8.4). Accordingly, humans constantly update the systems with which they interact.

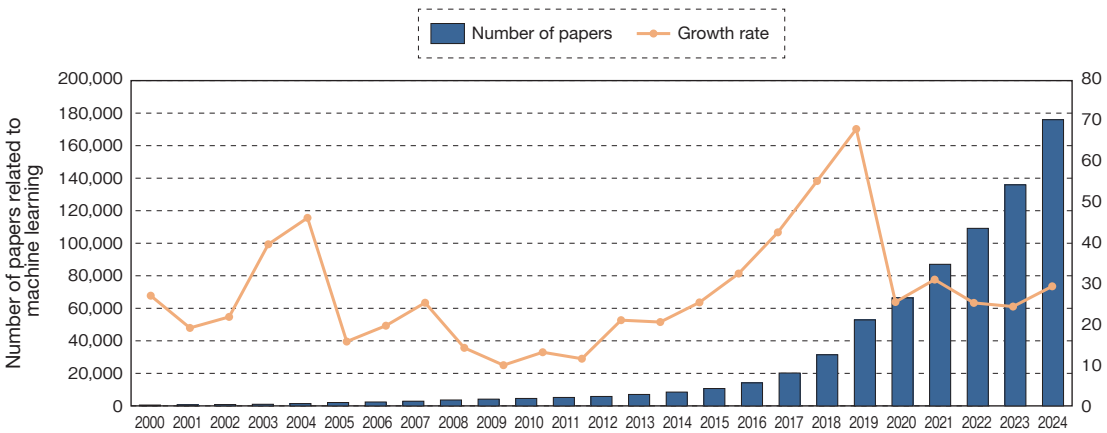


Figure 8.4 Trends in the number of machine learning-related publications (Scopus)

What has been clarified thus far is that the scope of human communication partners has expanded from direct interaction with people and animals to NPCs developed in the context of play, and eventually to advanced AI and systemic programs. Today, communication between people is increasingly supported by AI, for instance through machine translation, email proofreading, and suggestions for basic replies.

In the near future, humans may rely on chatbots for routine communication but turn to human counterparts for more complex tasks or emotionally nuanced interactions. This scenario mirrors how humans and AI complement each other in activities such as driving or piloting aircraft, depending on which party is better suited to the situation. Similarly, control of CAs is likely to alternate between humans and AI depending on the context.

However, technological development does not necessarily lead only to functional enhancement. For example, even if AI statistically proves to be a more appropriate communication partner, this does not guarantee human acceptance. A case in point is the difficulty humans sometimes experience in understanding the "best move" suggested by AI in shogi software. Future research may increasingly focus on which types of AI are more acceptable to humans and the forms of communication in which they should engage.

As communication technologies continue to advance, AI-controlled CAs are expected to become more widely accepted, not only as effective communication partners but also as companions who support human communication.

8.2.2. Research in the field of business administration

This section examines studies in business administration that are considered important for understanding the market diffusion of CAs, focusing on two types of AI-equipped objects: digital and physical entities. These studies were also compared with research trends across all academic disciplines.

Specifically, research trends related to CAs in both digital and physical entities were identified using Scopus. The methodology was as follows: for digital entities, "chatbot" was used as the primary search term; for physical entities, "service robot" was used. In both cases, "avatar" served as the secondary search term. Articles published in the past ten years (2015–2024) were searched by title, abstract, and keywords. The number of articles containing both search terms was counted. The search was then limited to the business domain (Business, Management, and Accounting), and the number of relevant publications was recorded.

First, regarding research trends across all disciplines, the number of publications on target (chatbot, service robot) × CA (Figures 8.2 and 8.3) was smaller than that on space (metaverse, AR) × CA (Figures 8.5 and 8.6). No publications addressed chatbot × CA in 2015 or service robot × CA in 2015–2016. While both space × agent and agent × exterior can be considered important categories for examining different research dimensions, research on space × agent may be more clearly classifiable and therefore easier to organize. Alternatively, this discrepancy may result from the choice of search terms. Nevertheless, it indicates varying levels of recognition and attention across these domains.

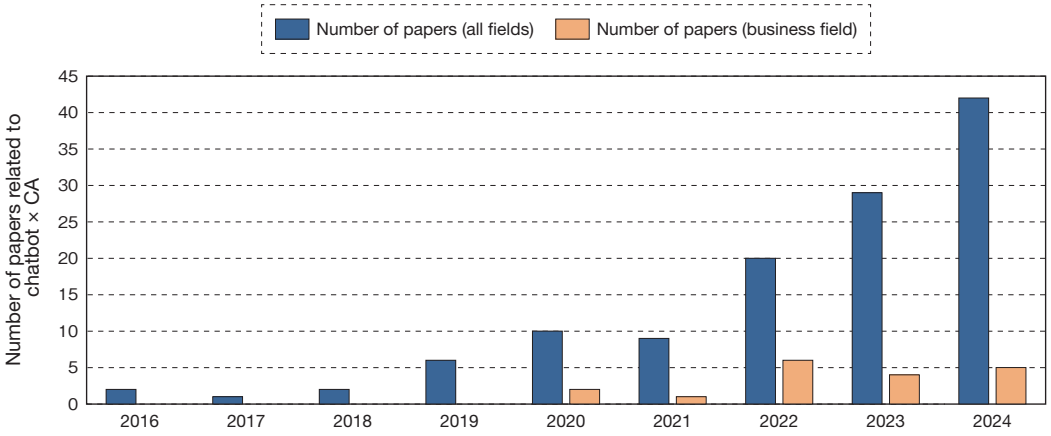


Figure 8.5 Trends in the number of chatbot × CA-related publications

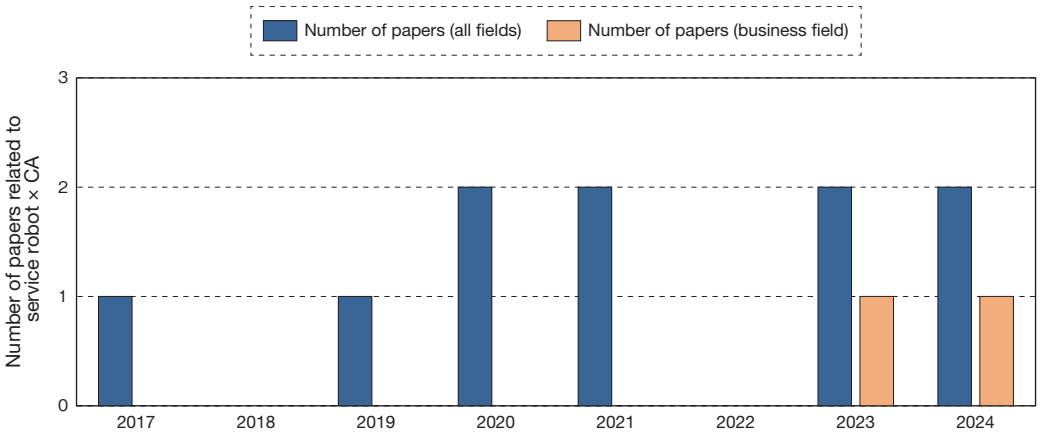


Figure 8.6 Trends in the number of service robot × CA-related publications

With this in mind, overall research trends can be summarized. Although the number of publications on chatbot × CA remained relatively low throughout the period, academic interest is evident, and research volume has increased significantly since 2022. In contrast, the number of service robot × CA-related publications remained consistently low. This is likely because service robots already exist in physical form, making their conceptual pairing with CAs—which often implies a digitally projected or symbolic representation—less compatible.

In the field of business administration, the number of chatbot × CA-related publications has remained stable since their emergence in 2020, peaking in 2022. In contrast, only one publication on service robot × CA appeared in 2023 and 2024. Whether interest in this research domain will continue remains unclear. Given the limited number of publications, drawing firm conclusions from publication counts alone may be premature. However, interpreting the number of papers as a potential indicator of market diffusion suggests that chatbot × CA-related services currently occupies a more favorable position.

8.3. The potential of CAs: integration of communication spaces and objects

This chapter outlines the history and potential of elemental technologies related to CAs from the perspectives of communication space and communication objects. These two perspectives have often been discussed separately. However, for the future development of CAs, integrating information from both perspectives is essential.

An overview is provided in a paper published in 2024.[75] The authors discuss four possible forms of AI concierges designed for communication with customers: dialogue interfaces, virtual CAs, projection-based images, and service robots. The study demonstrates the necessity of examining and integrating the communication spaces and objects presented in this chapter. In other words, it indicates possible directions for the future development of CAs. At the same time, the study remains conceptual, and empirical research continues to present an attractive challenge. Moreover, ample scope exists for practical implementation and refinement.

Based on the preceding discussion, the necessity of CAs can be structured using a conceptual framework for communication technology development (Figure 8.7). Direct human-to-human communication has evolved along two major axes: space and objects. The expansion of space has taken the form of digital spaces enabled by online technology. In this context, the role of a CA is to function as a digital surrogate of the self, assisting in self-expression within the digital environment.

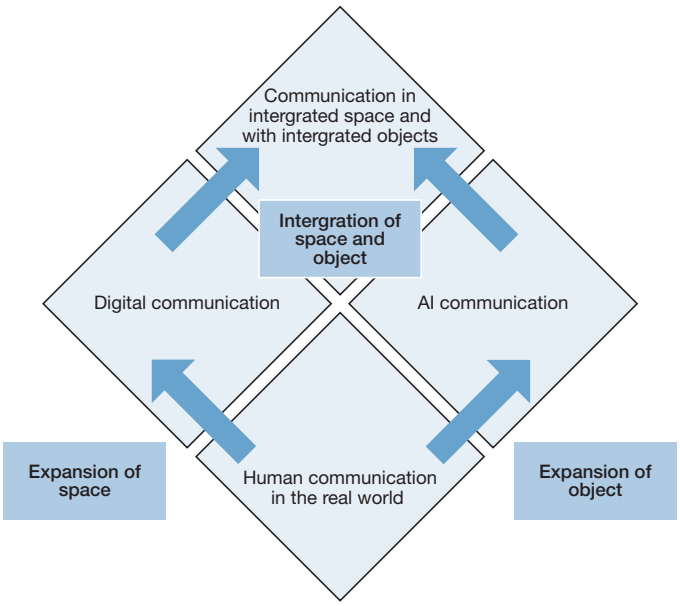


Figure 8.7 Conceptual framework of communication technology development

75. Liu, S. Q.et al. (2024). "AI concierge in the customer journey: what is it and how can it add value to the customer?" *Journal of Service Management, 35*(6), 136-158. https://doi.org/10.1108/JOSM-12-2023-0523

The expansion of the objective, on the other hand, has manifested as the advancement of AI. Here, the role of a CA is to humanize AI, mitigating the discomfort people may feel toward AI precisely because it is not human. In short, communication technologies aimed at either space or objects, which have developed independently, now hold the potential for further evolution through ongoing integration.

In this process, the role of CAs is not only to fulfill the original functions developed within each domain (self-expression in digital space, humanization of AI) but also to enable seamless integration and switching between them. Considering which types of CAs in physical reality can enable authentic self-expression while providing AI representations that do not evoke discomfort will become increasingly important. What implementations are necessary to support natural transitions between physical and digital spaces?

9 Research trends in CAs

9.1. Overview of the analysis target

This chapter examines trends in CAs from an academic research perspective. The analysis is based on materials indexed by Scopus. Academic works published up to the end of 2023 were searched using the keyword "avatar" (interpreted here as CA), including articles, reviews, conference papers, conference reviews, and book chapters. After removing duplicates, 14,271 records were obtained for analysis. These records included 6,300 conference papers, 6,069 articles, 1,003 book chapters, 546 review articles, and 353 conference reviews (Figure 9.1).

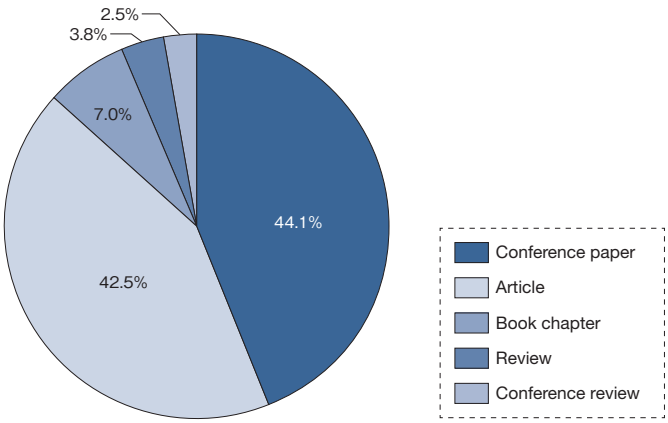


Figure 9.1 Composition of materials used for analysis

Considering the trend in the number of publications, a significant increase has been observed in recent years (Figure 9.2). This topic was nearly absent in the 1990s. However, the number of papers published has grown steadily since 2000, with an accelerating trend, particularly after 2020. The first quartile of publication year was 2011, the median was 2017, and the third quartile was 2021. Given that the aggregation period ended in 2023, approximately 25% of all CA-related publications were published within the last three years.

However, the number of publications did not increase continuously over the study period. In 2015, the number of publications declined compared with 2014, and growth remained somewhat stagnant from 2013 to 2018. Thereafter, a rapid increase occurred, with 1,803 papers published in 2023.

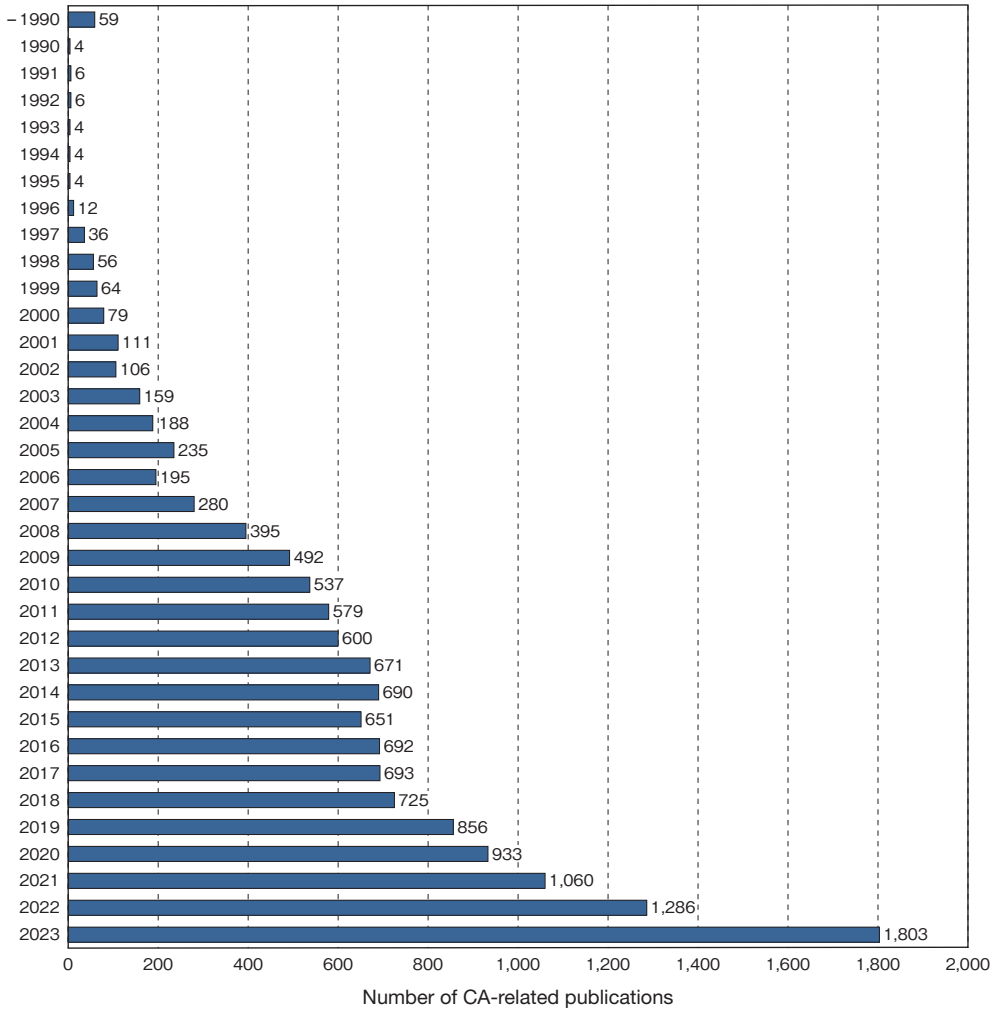


Figure 9.2 Number of CA-related publications over time

9.2. Trends by publication journal

Next, we examine the distribution of publications by journal. All journal names are presented using their abbreviations, with a correspondence table for the full titles provided in Section 9.6.

Regarding conference and conference review papers, the journal with the highest number of CA-related publications was Lect. Notes Comput. Sci., with 774 papers (715 conference papers and 59 conference review papers), followed by ACM Int. Conf. Proc. Ser. with 340 (317 + 23), Conf. Hum. Fact Comput. Syst. Proc. with 232 (231 + 1), Commun. Comput. Info. Sci. with 124 (111 + 13), and Proc. ACM Symp. Virtual Reality Softw. Technol. VRST with 103 (97 + 6) papers (Figure 9.3). These journals primarily publish research in computer science, and conference proceedings from the Association for Computing Machinery (ACM) frequently appear among the top-ranked publications. In addition to ACM, many journals compile

papers presented at conferences organized by the Institute of Electrical and Electronics Engineers (IEEE), a leading society in electrical and electronic engineering.

However, when considering the combined number of journal articles, review papers, and book chapters, several journals in the humanities and social sciences stand out. The journal with the most CA-related publications was Comput. Hum. Behav., followed by IEEE Trans. Visual Comput. Graphics, Front. Psychol., PLoS ONE, Sci. Rep., and Front. Virtual. Real. (Figure 9.4). Many of these journals are related to psychology. For instance, Comput. Hum. Behav. is classified by SJR[76] as an interdisciplinary journal spanning the arts, humanities, computer science, and psychology, primarily addressing topics related to human-computer interaction (HCI). Similarly, Front. Psychol. is psychology-oriented, reflecting that many studies on HCI have been conducted from a psychological perspective.

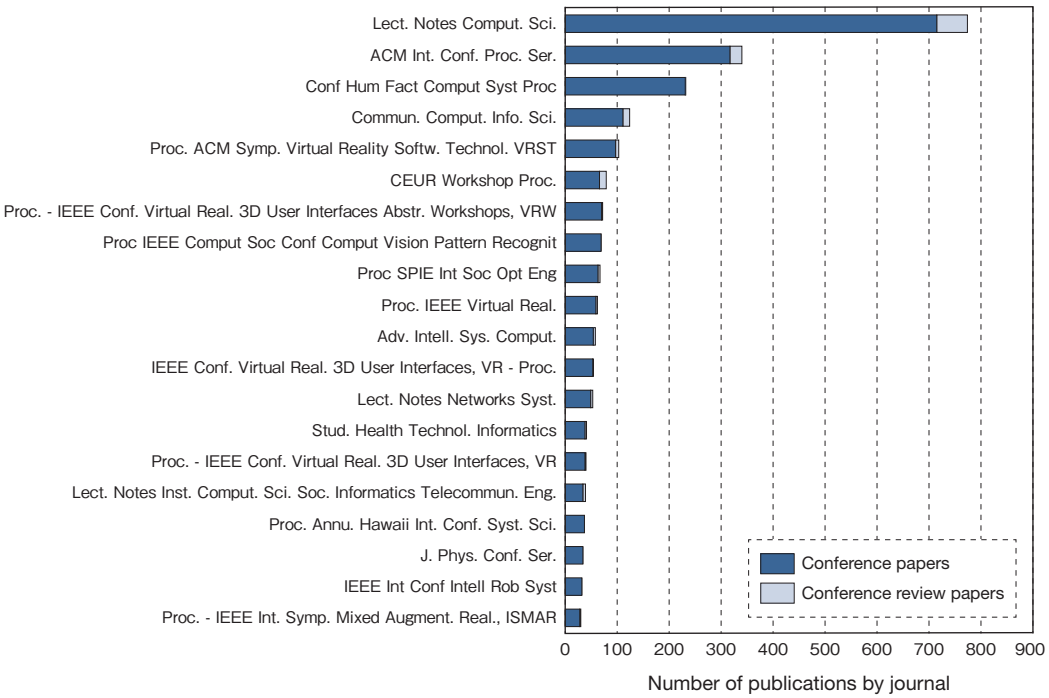


Figure 9.3 Number of CA-related publications by journal (conference papers and conference review papers)

76. Scimago Journal & Country Rank. https://www.scimagojr.com/

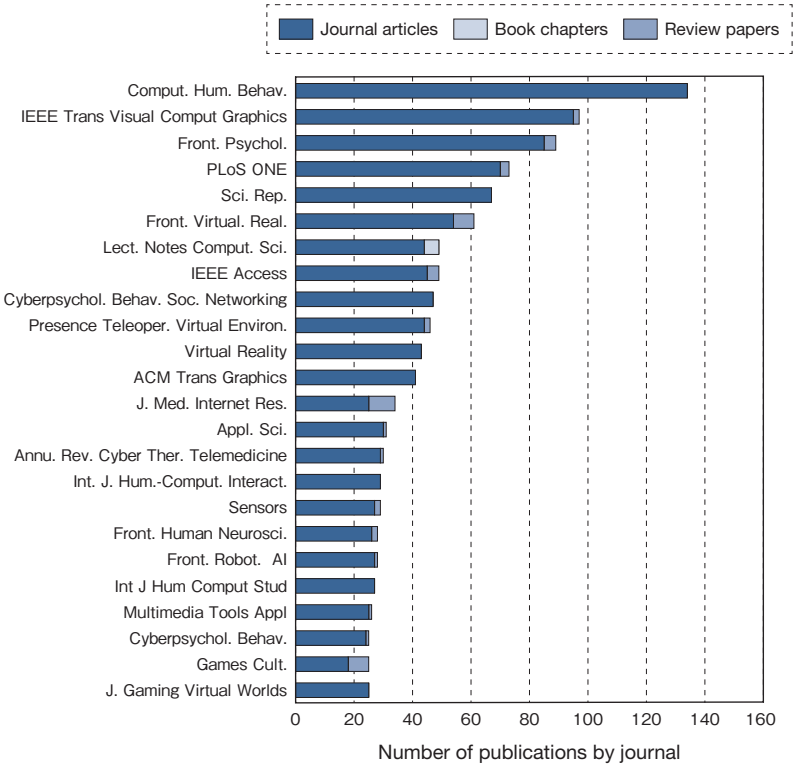


Figure 9.4 Number of CA-related publications by journal (journal articles, review papers, and book chapters)

Next, using publication year data, we examined how the number of CA-related publications shifted by journal type. In both lists—journals with 10 publications up to 2010 (Figure 9.5) and those with 30 publications from 2011 to 2023 (Figure 9.6)—Lect. Notes Comput. Sci. contained the largest number of studies. Conf. Hum. Fact Comput. Syst. Proc. ranked second up to 2010 and third from 2011 onward, whereas ACM Int. Conf. Proc. Ser. ranked third through 2010 and second since 2011, indicating that the top journals remained relatively stable over time. However, Comput. Hum. Behav., which ranked fourth in the 2011–2023 period, had only eight publications up to 2011, showing significant growth in recent years. Similarly, Commun. Comput. Info. Sci. published only two papers before 2010, and IEEE Trans. Visual Comput. Graphics published only four. The output of both journals has increased substantially since then.

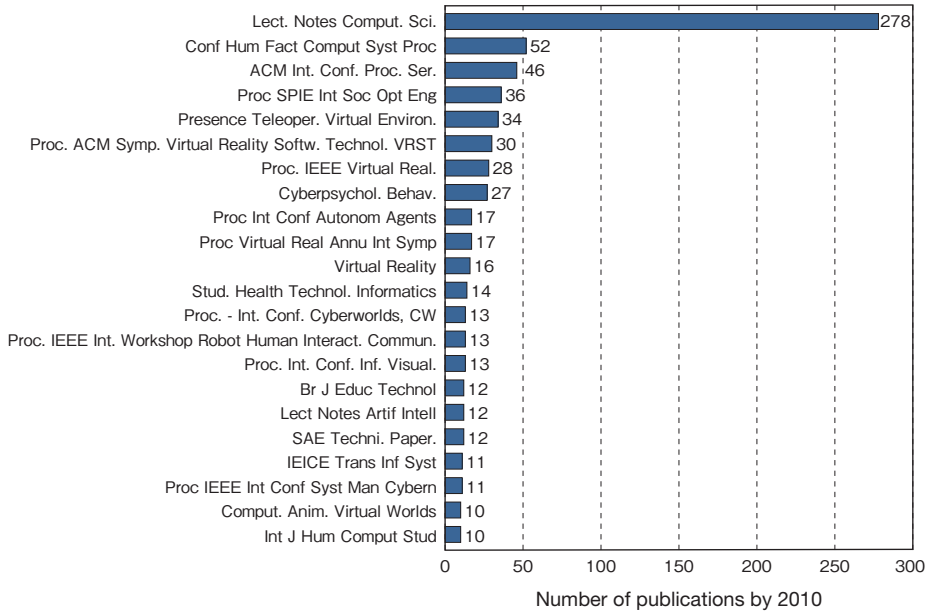


Figure 9.5 Number of CA-related publications through 2010

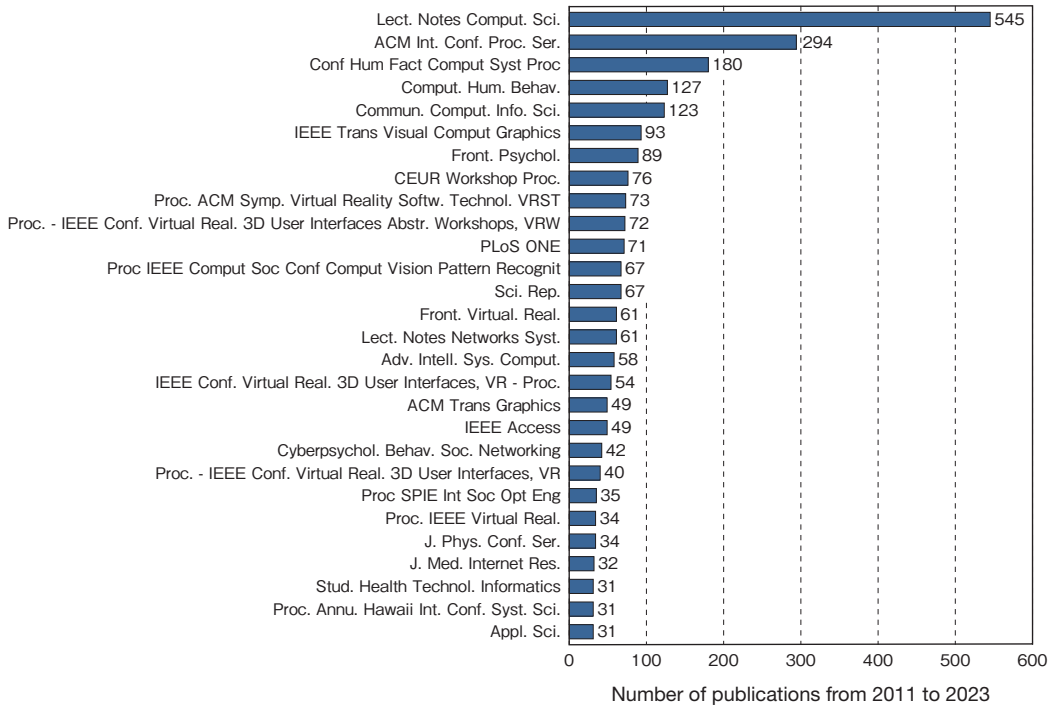


Figure 9.6 Number of CA-related publications from 2011 to 2023

9.3. Trends by country

This section provides an overview of trends by country based on the affiliation of the corresponding author, as listed in the publication database. Note that this tabulation is based on the institutional affiliation of the corresponding author; therefore, a higher number of publications does not necessarily indicate a concentration of research capacity in that country. Additionally, researchers affiliated with Japanese institutions are not necessarily of Japanese nationality, while Japanese nationals affiliated with institutions abroad are counted in the countries where their institutions are located. This implies that caution is warranted when interpreting the data.

First, when aggregating the total number of publications across the entire period, the United States published the largest number of papers. Following the United States, the United Kingdom, Japan, and Germany occupied the second to fourth positions, with publication numbers among these countries showing no significant differences (Figure 9.7). They were followed by France and China, with a slight drop before Canada, South Korea, and Spain. This indicates that Japanese research institutions perform well in this field.

Figures 9.8 and 9.11 summarize the number of publications for four discrete periods. Figure 9.8 shows the results for papers published up to the year 2000. As the total number of publications during this period was limited, only countries with two or more papers were included. According to the results, Japan ranked second after the United States, indicating that research on CAs was already being conducted at an early stage. Japan was followed by France, the United Kingdom, and Germany. Overall, these countries also appear among the top-ranked nations.

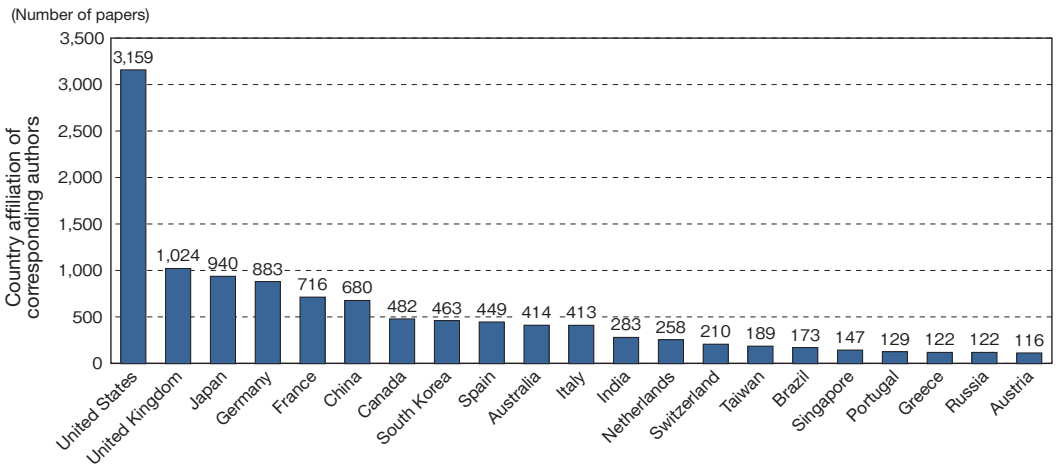


Figure 9.7 Country affiliation of corresponding authors (all periods)

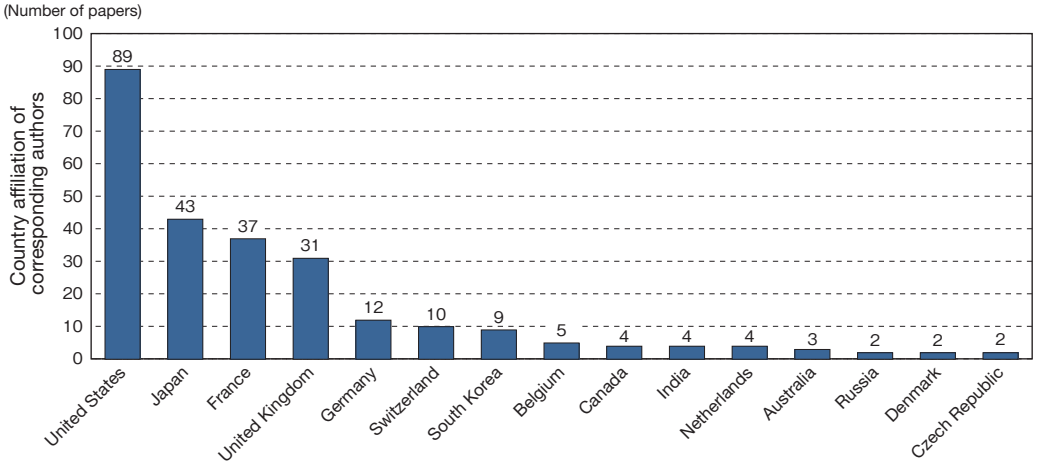


Figure 9.8 Country affiliation of corresponding authors (Up to 2000)

Figure 9.9 presents the top 20 countries and regions in terms of CA-related research output from 2001 to 2010. The data show that China ranks fifth, following the United States, Japan, the United Kingdom, and France, indicating that research originating in China has also increased in this field. Other Asian countries, such as South Korea and Taiwan, are also represented, suggesting that research activity in Asia is gaining momentum.

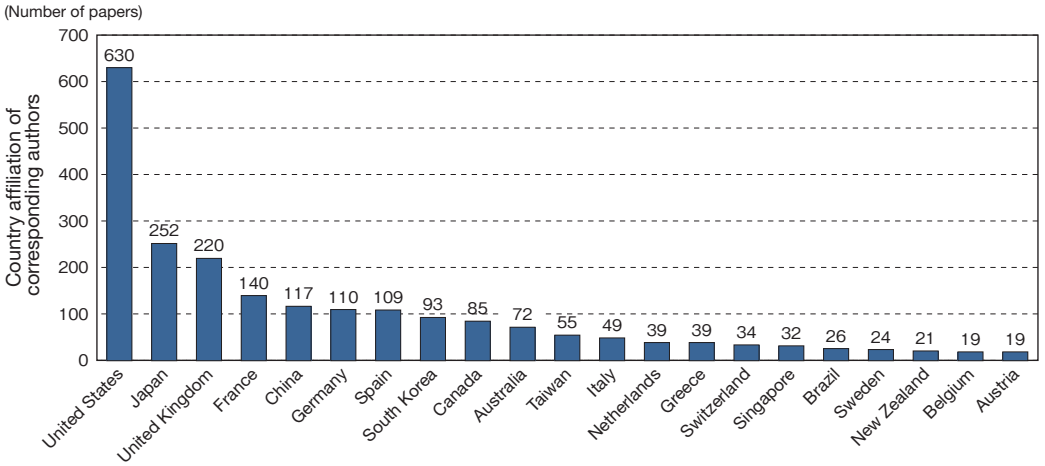


Figure 9.9 Country affiliation of corresponding authors (2001–2010)

Figure 9.10 displays the results for 2011 to 2020. The rankings were as follows: United States, United Kingdom, Germany, France, Japan, and China. This suggests that Japan's research dissemination capacity declined slightly during this period.

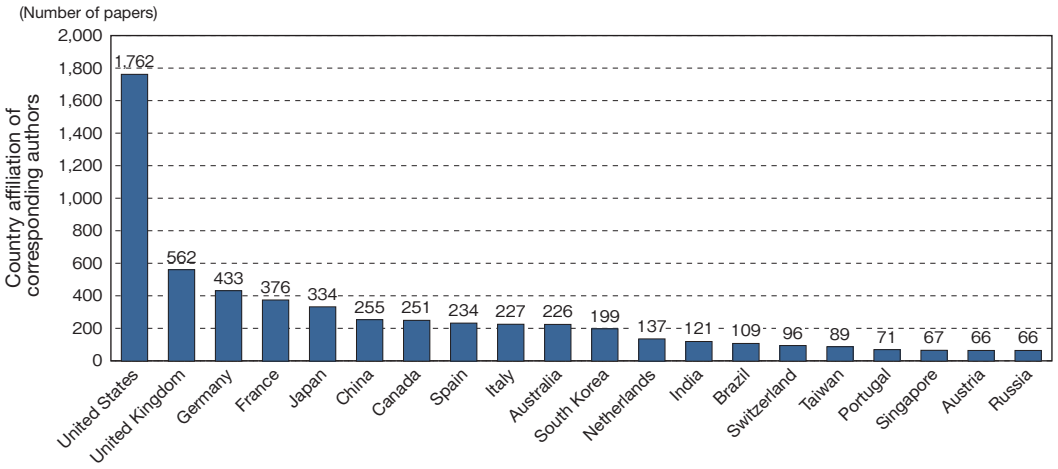


Figure 9.10 Country affiliation of corresponding authors (2011–2020)

The most recent results are shown in Figure 9.11, covering the period from 2021 to 2023. The ranking is as follows: the United States, Germany, Japan, China, and the United Kingdom. During this period, Japanese institutions published 311 papers, indicating active dissemination of research output. Compared with the 2011–2020 period, this represents a substantial increase. In the United States, 1,762 papers were published over ten years from 2011 to 2020, averaging 176.2 papers per year. However, in just three years from 2021, the United States has already published 678 papers, an average of 226 papers per year, demonstrating a significant year-on-year increase. Similarly, Japan published an average of 33.4 papers per year from 2011 to 2020 but has published an average of 103.7 papers per year since 2021. This indicates that the field is expanding and research is accelerating significantly.

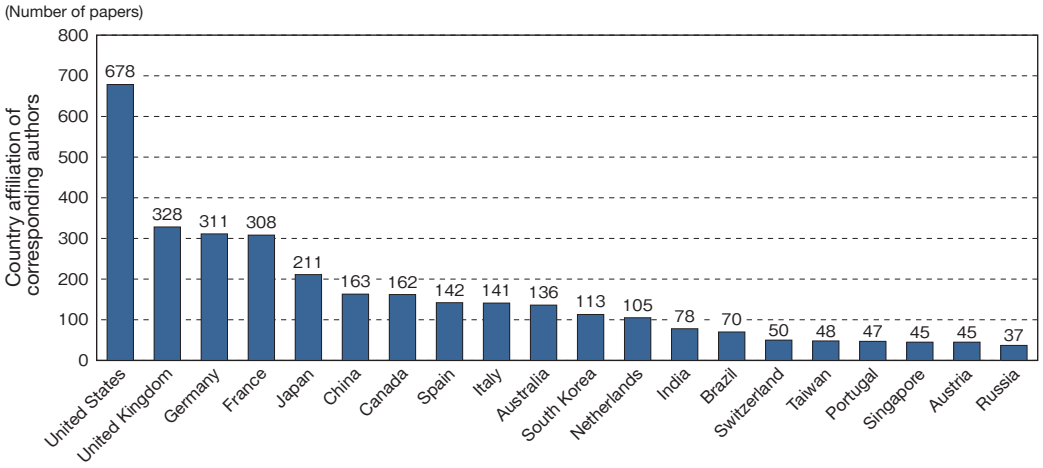


Figure 9.11 Country affiliation of corresponding authors (2021–2023)

9.4. Major researchers

The analyzed database contained information on the researchers who contributed to each paper as authors, allowing the tabulation of the number of publications per author. Note that in this section, even coauthored papers are counted as a single publication.

Figure 9.12 shows the number of publications aggregated by authors, highlighting those who have published 15 or more papers in this field. Marc Erich Latoschik and Mel Slater ranked first with 52 publications each. Latoschik is affiliated with the University of Würzburg, Germany, and specializes in VR and HCI. Slater is also a prolific VR researcher, but his expertise lies in psychology and neuroscience; he is affiliated with the University of Barcelona, Spain. Notably, both are affiliated with institutions outside the United States.

Third, Tomio Watanabe, affiliated with Okayama Prefectural University, has produced numerous contributions, with 48 published papers. Many other Japanese researchers are ranked among the top of the list. In addition, other researchers are affiliated with Japanese institutions. Michael Cohen has conducted research at the University of Aizu for many years and, as of 2025, is affiliated with Higashi Nippon International University, while Helmut Prendinger is a researcher at the National Institute of Informatics. In Figure 9.12, Japanese researchers and researchers affiliated with Japanese institutions are indicated by orange bars. Figure 9.13 summarizes the major Japanese researchers (including those affiliated with overseas institutions) and the researchers active at Japanese research institutions.

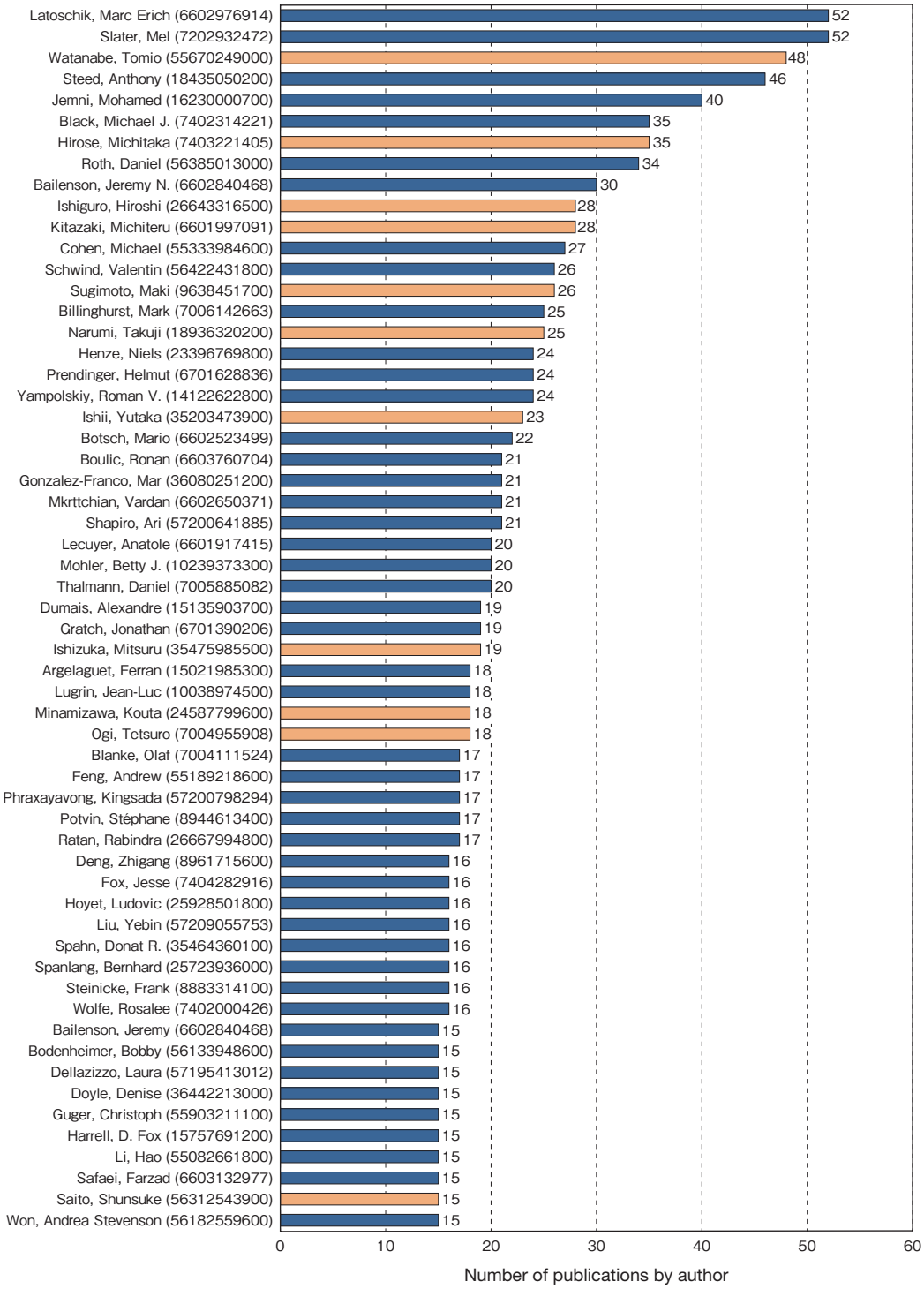


Figure 9.12 Number of publications per author (all periods)

Figure 9.13 Major Japanese researchers

Name	Website
Watanabe, Tomio (55670249000)	https://researchmap.jp/read0043929
Hirose, Michitaka (7403221405)	https://researchmap.jp/michitaka_hirose
Ishiguro, Hiroshi (26643316500)	https://researchmap.jp/read0013747
Kitazaki, Michiteru (6601997091)	https://researchmap.jp/mich
Cohen, Michael (55333984600)	https://researchmap.jp/read0099060
Sugimoto, Maki (9638451700)	https://researchmap.jp/makisugimoto
Narumi, Takuji (18936320200)	https://researchmap.jp/takujinarumi
Prendinger, Helmut (6701628836)	https://researchmap.jp/helmut/
Ishii, Yutaka (35203473900)	https://researchmap.jp/read0062544
Ishizuka, Mitsuru (35475985500)	https://researchmap.jp/read0046325
Minamizawa, Kouta (24587799600)	https://researchmap.jp/ktminamizawa
Ogi, Tetsuro (7004955908)	https://researchmap.jp/t.ogi

9.5. Keyword trends

This section provides an overview of keyword trends by compiling the keywords assigned to each paper by year. As the keywords were recorded in the database exactly as they appeared in the papers, preprocessing was conducted to correct variations in notation. First, all capitalized keywords were converted to lowercase (e.g., Virtual → virtual, Human → human). Second, all keywords recorded in plural form were converted to singular (e.g., articles → article, men → man).

The results of the keyword analysis are summarized in Figure 9.14. They show that "virtual reality" and "human" are by far the most frequently appearing keywords across all periods, followed by "female" and "male." A word cloud illustrating keyword frequency for the entire period is presented in Figure 9.15. In this figure, larger font sizes represent higher frequency, while smaller font sizes indicate less frequent appearance. Note that "virtual reality" and "human" were excluded from this word cloud due to their overwhelmingly high frequency. A version including these keywords is provided in Section 9.7.

Keyword trends by period are shown in Figures 9.16 and 9.17. The left side of Figure 9.16 displays keywords found in papers published up to 2000, whereas the right side shows keywords from 2001 to 2010. Similarly, Figure 9.17 presents keywords from 2011 to 2020 on the left and from 2021 to 2023 on the right.

Figure 9.14 Frequent keywords

	-2000	2001-2010	2011-2020	2021-	all
Virtual reality	132	1035	2019	1197	4383
Human	50	241	1799	1051	3141
Female	14	96	1151	389	1650
Male	9	103	1141	371	1624
Interactive computer graphic	36	344	829	227	1436
Avatar	43	288	703	389	1423
Adult	12	89	892	328	1321
Three-dimensional computer graphic	42	234	637	374	1287
Article	27	126	637	453	1243
Human-computer interaction	27	215	557	226	1025
Animation	34	327	304	141	806
Virtual world	15	252	313	104	684
User interface	21	183	279	198	681
Young adult	0	18	529	87	634
Controlled study	0	32	327	247	606
Facial expression	4	111	287	150	552
e-Learning	1	73	253	189	516
Artificial intelligence	13	98	238	123	472
Augmented reality	7	25	205	224	461
Student	2	63	235	148	448
Behavioral research	0	66	236	121	423
Computer simulation	20	164	191	33	408
Adolescent	9	21	300	69	399
Internet	14	177	167	17	375
Three dimensional	6	220	148	0	374
Human experiment	0	25	196	136	357
Physiology	3	19	266	63	351
Emotion	0	56	161	128	345
Middle aged	0	10	287	46	343
Video game	0	41	236	57	334

Figure 9.15 Frequent keywords (all periods, excluding "virtual reality" and "human")

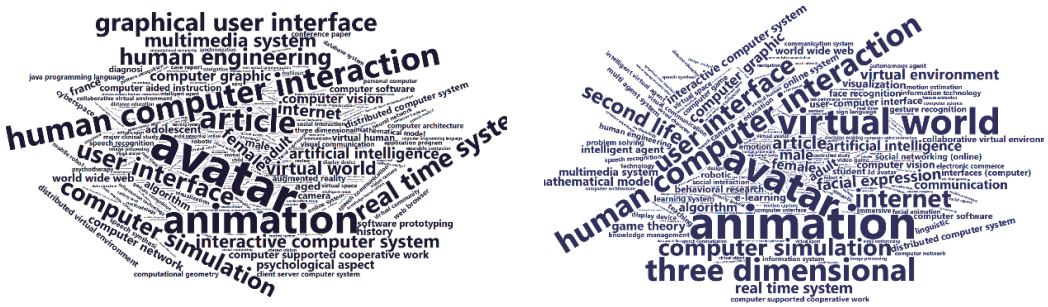


Figure 9.16 Frequent keywords (left: up to 2000, right: 2001–2010)

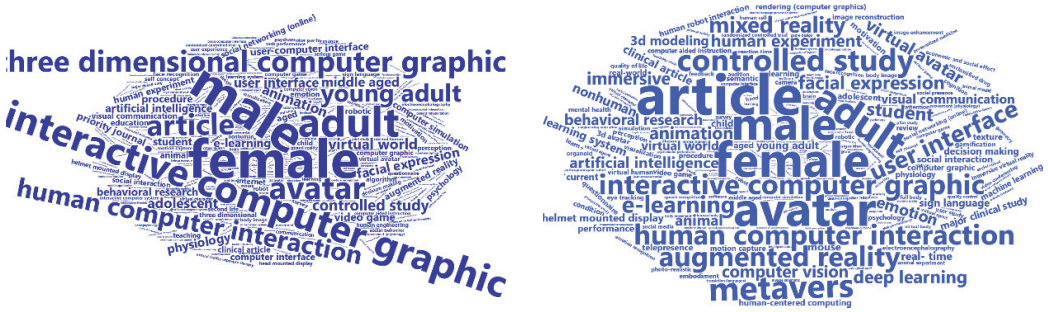


Figure 9.17 Frequent keywords (left: 2011–2020, right: 2021–2023)

While differences in the prevalent keywords across time periods can be seen in the word clouds, Figures 9.18 and 9.19 highlight the keywords that experienced the most significant changes in frequency between 2011 and 2020 and between 2021 and 2023, respectively. These figures list the top 20 keywords that increased and decreased the most, based on their average annual appearances during the two periods. Only keywords that appeared at least 100 times in both periods were included in the analysis.

Among the increasing keywords, "metaverse" saw the most dramatic growth, with a 45,000% increase (from 0.2 appearances per year to 90). This aligns with the sharp spike observed in Figure 9.20 based on Google Trends data around October 2021, suggesting that the surge in publications was linked to the metaverse boom during that period. However, because Google Trends also shows a decline in interest throughout 2022, the sustainability of this trend remains uncertain.

The next largest increase was observed for "deep learning," which rose by 1,373% (from 3.4 to 46.7 per year), followed by "machine learning" at 613% (from 3.7 to 22.7 per year). This reflects a broader trend in the application of deep and machine learning technologies in research. The third most increased keyword was "3D modeling," which likely replaced the previously common term "three dimensional," the top decreasing keyword, indicating a change in terminology rather than in topic. The fourth most increased keyword was "immersive," which has also been gaining popularity in recent years and is expected to remain prominent, as suggested by Figure 9.20.

Among the declining keywords, "Second Life" ranked second, with a 21% decrease (from 12.5 to 2.7 per year). This reflects the waning popularity of the Second Life platform and the corresponding decrease in academic output. "Education" was the third most declining keyword, decreasing by 77% (from 17.2 to

4 per year), suggesting reduced academic interest in education-related topics within the CA research field.

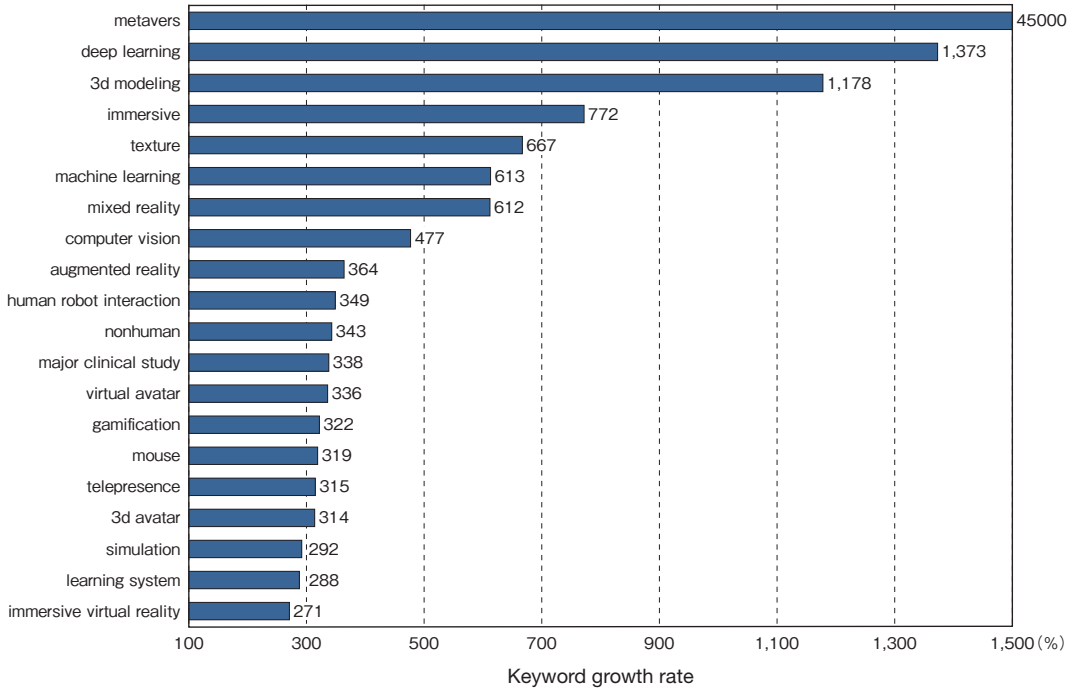


Figure 9.18 Increasing keywords (2021–2023 vs. 2011–2020)

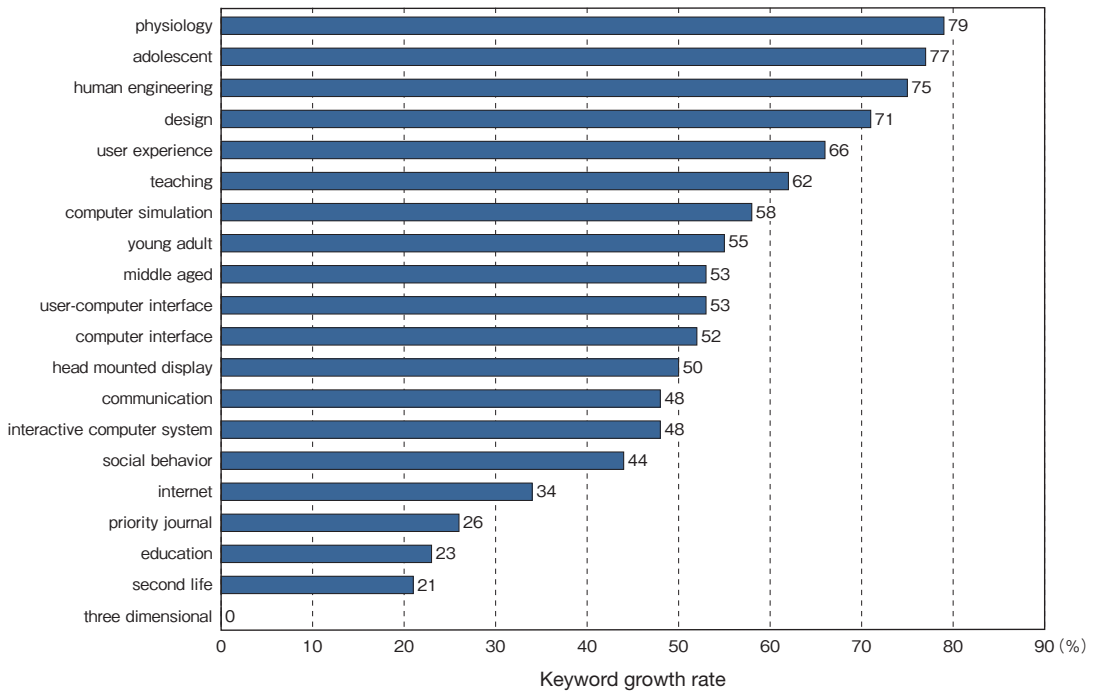


Figure 9.19 Decreasing keywords (2021–2023 vs. 2011–2020)

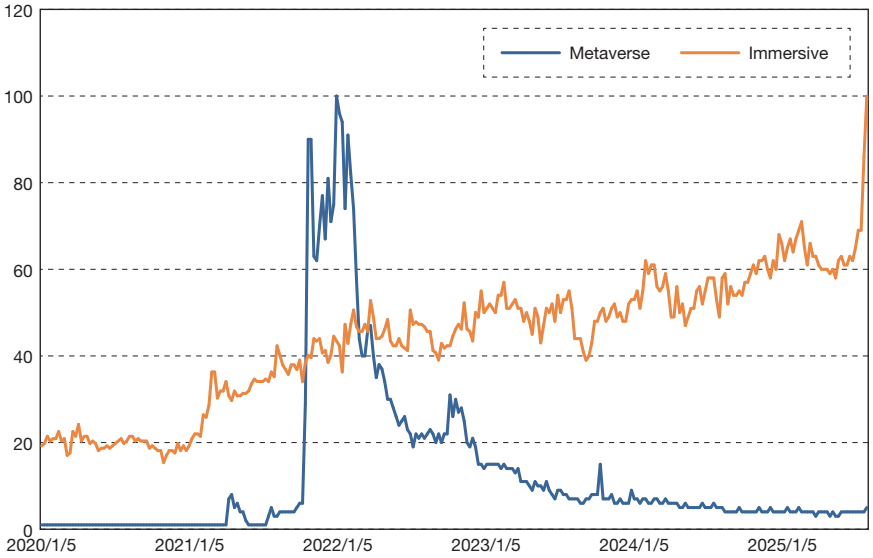


Figure 9.20 Reference: Google Trends search volume[77]

9.6. Journal titles and abbreviations

Figure 9.21 shows the journals that published a significant number of articles in this research field, highlighting those with 25 or more publications.

Figure 9.21 Number of publications by journal (selected journals with ≥25 publications)

Journal title	Abbreviation
Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)	Lect. Notes Comput. Sci.
ACM International Conference Proceeding Series	ACM Int. Conf. Proc. Ser.
Conference on Human Factors in Computing Systems - Proceedings	Conf Hum Fact Comput Syst Proc
Computers in Human Behavior	Comput. Hum. Behav.
Communications in Computer and Information Science	Commun. Comput. Info. Sci.
Proceedings of the ACM Symposium on Virtual Reality Software and Technology, VRST	Proc. ACM Symp. Virtual Reality Softw. Technol. VRST
IEEE Transactions on Visualization and Computer Graphics	IEEE Trans Visual Comput Graphics
Frontiers in Psychology	Front. Psychol.
CEUR Workshop Proceedings	CEUR Workshop Proc.
PLoS ONE	PLoS ONE
Proceedings of SPIE - The International Society for Optical Engineering	Proc SPIE Int Soc Opt Eng
Proceedings of the IEEE Computer Society Conference on Computer Vision and Pattern Recognition	Proc IEEE Comput Soc Conf Comput Vision Pattern Recognit
Scientific Reports	Sci. Rep.
Proceedings - IEEE Virtual Reality	Proc. IEEE Virtual Real.
Frontiers in Virtual Reality	Front. Virtual. Real.
Lecture Notes in Networks and Systems	Lect. Notes Networks Syst.
Advances in Intelligent Systems and Computing	Adv. Intell. Sys. Comput.

77. Google Trends.
https://trends.google.com/trends/

Journal title	Abbreviation
Presence: Teleoperators and Virtual Environments	Presence Teleoper. Virtual Environ.
ACM Transactions on Graphics	ACM Trans Graphics
IEEE Access	IEEE Access
Cyberpsychology, Behavior, and Social Networking	Cyberpsychol. Behav. Soc. Networking
Studies in Health Technology and Informatics	Stud. Health Technol. Informatics
Virtual Reality	Virtual Reality
26th IEEE Conference on Virtual Reality and 3D User Interfaces, VR 2019 - Proceedings	IEEE Conf. Virtual Real. 3D User Interfaces, VR - Proc.
Proceedings of the Annual Hawaii International Conference on System Sciences	Proc. Annu. Hawaii Int. Conf. Syst. Sci.
Computer Animation and Virtual Worlds	Comput. Anim. Virtual Worlds
Journal of Medical Internet Research	J. Med. Internet Res.
Journal of Physics: Conference Series	J. Phys. Conf. Ser.
IEEE International Conference on Intelligent Robots and Systems	IEEE Int Conf Intell Rob Syst
Applied Sciences (Switzerland)	Appl. Sci.
Annual Review of CyberTherapy and Telemedicine	Annu. Rev. Cyber Ther. Telemedicine
International Journal of Human-Computer Interaction	Int. J. Hum.-Comput. Interact.
Proceedings of the European Conference on Games-based Learning	Proc. European Conf. Games-based Learn.
Proceedings of the IEEE International Conference on Computer Vision	Proc IEEE Int Conf Comput Vision
Frontiers in Human Neuroscience	Front. Human Neurosci.
Proceedings of the ACM on Human-Computer Interaction	Proc. ACM Hum. Comput. Interact.
Cyberpsychology and Behavior	Cyberpsychol. Behav.
International Journal of Human Computer Studies	Int J Hum Comput Stud
Lecture Notes of the Institute for Computer Sciences, Social-Informatics and Telecommunications Engineering, LNICST	Lect. Notes Inst. Comput. Sci. Soc. Informatics Telecommun. Eng.
Proceedings - 2021 IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops, VRW 2021	Proc. - IEEE Conf. Virtual Real. 3D User Interfaces Abstr. Workshops, VRW
Multimedia Tools and Applications	Multimedia Tools Appl
Games and Culture	Games Cult.
Journal of Gaming and Virtual Worlds	J. Gaming Virtual Worlds
Journal of High Energy Physics	J. High Energy Phys.
Procedia Computer Science	Procedia Comput. Sci.
Proceedings of the Human Factors and Ergonomics Society	Proc Hum Factors Ergon Soc

9.7. Word clouds including "virtual reality" and "human"

For completeness, word clouds that include the keywords "virtual reality" and "human" are presented in the following figures (Figures 9.22–9.24).

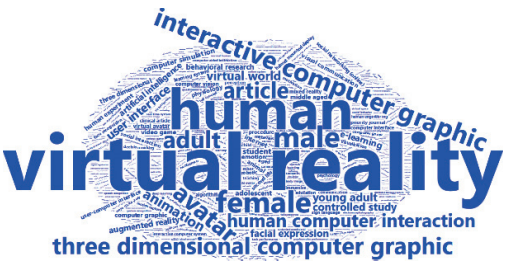


Figure 9.22 Frequent keywords (all periods, including "virtual reality" and "human")

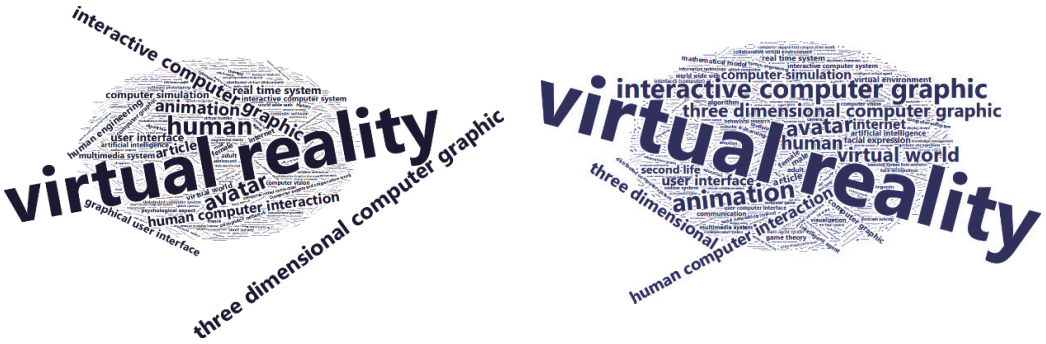


Figure 9.23 Frequent keywords (left: up to 2000, right: 2001–2010)

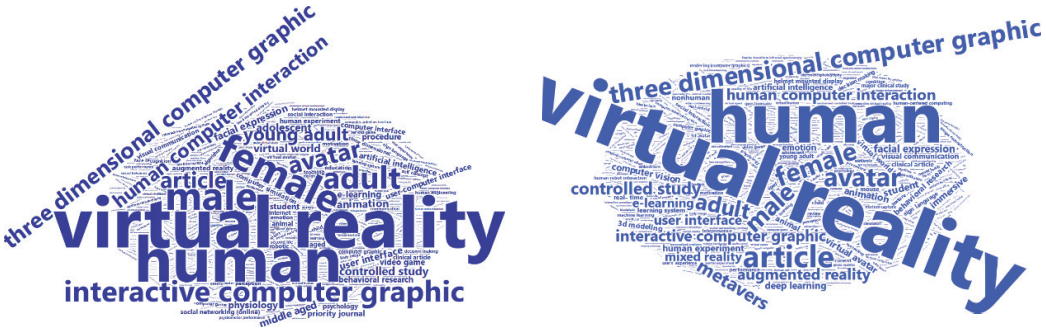


Figure 9.24 Frequent keywords (left: 2011–2020, right: 2021–2023)

Conclusion

This white paper outlines the current state of CAs based on survey data, literature reviews, and case studies. It presents factual accounts of CA usage and awareness in Japan and abroad, the social impact of CA utilization, its applications in corporate contexts such as commerce and employee training, and its relationship with relevant technologies and legal frameworks. Although CAs hold broad potential for addressing social challenges, public recognition remains insufficient; as a result, they have not yet been widely adopted in society. Furthermore, compared with countries such as the United States, Japan cannot be considered a leader in terms of CA recognition or usage. Additionally, issues such as privacy, security, and alignment with existing legal systems, including copyright laws, must be addressed. By confronting these challenges through collaborative efforts among governments, research institutions, corporations, and users, a society in which many people can safely utilize CAs in diverse settings may be realized.

Similar to the internet, machine learning, and robotics, CAs can generate economic value by integrating them with other technologies to form products and services. Such component technologies, although capable of exerting a wide-ranging influence, often do not have immediate, clear use cases. Their application and significance can change drastically depending on the technologies with which they are combined and how they are embedded within business contexts. Over the past 30 years, the internet has significantly transformed the economy and society as a result of countless experiments with technological and business combinations, from which only those that proved valuable were ultimately adopted. Similarly, CA development must involve experimentation, use, and collective selection. To envision the potential value of integrating CAs with various technologies and business models, researchers should review and organize the novel combinations currently being explored. In practice, we already see CAs combined with technologies such as HMDs, robots, and AI, and integrated into businesses such as gaming, social media, marketing, and commerce. Even at a more personal level, photo-editing apps on smartphones are seeing widespread use among younger generations. Looking ahead, researchers and practitioners should continue experimenting with a broader array of technological and business combinations while keeping both long-term prospects and familiar everyday use cases of CAs in mind to expand their use and recognition.

Component technologies, such as CAs, are refined through actual use, through which their significance becomes clearer and their challenges become more apparent. The immersive experiences, high degree of customization, and ability to alter age, gender, and physical characteristics enabled by CAs are not yet fully understood in terms of their societal implications. Therefore, merely developing advanced technologies is insufficient; users, businesses, and other stakeholders must also actively engage with and test them. Although stakeholders must remain cautious about the societal risks these technologies may pose, actively using and applying them in practice allows people to overcome their limitations and unlock new possibilities. As people become accustomed to CAs, discussions among users, business professionals, and policymakers become increasingly grounded and productive. We hope that new initiatives involving CAs will thrive in the fields of economics and business, and that CAs will become an indispensable element of future society, with Japan playing a leading role in this transformation. With this aspiration, we close this white paper.

Acknowledgement

We would like to thank the many people who provided support and cooperation during the preparation of this white paper. We express our deepest gratitude to them.

This white paper was prepared with the support of JST [Moon Shot Type R&D Project] [JPMJMS2215]. We would like to express our sincere gratitude to all parties involved in this project for their support of this research and their valuable advice.

We also thank those who provided insights and opinions on the contents of this white paper, as well as the companies and organizations that cooperated in the research and analysis.

We hope that this white paper will be useful and contribute to future discussions.

Finally, we once again extend our thanks to all those involved in the preparation of this white paper.

List of assignments

Introduction:	Shinichi Yamaguchi
Chapter 1:	Shinichi Yamaguchi and Hidetaka Oshima
Chapter 2:	Shinichi Yamaguchi and Hidetaka Oshima
Chapter 3:	Shinichi Yamaguchi, Hidetaka Oshima, Eri Inoue
Chapter 4:	Shinichi Yamaguchi, Hidetaka Oshima, Shinnosuke Tanabe
Chapter 5:	Satoshi Nakano
Chapter 6:	Tatsuo Tanaka
Chapter 7:	Tatsuo Tanaka
Chapter 8:	Takeyasu Ichikohji
Chapter 9:	Sotaro Katsumata and Wen Hai
Conclusion:	Fumihiko Ikuine

About the Editor

RISING: Research group on Information Society Innovation for the Next Generation

RISING is an interdisciplinary research team that takes a measured and empirical approach to understanding how emerging technologies—such as avatars and artificial intelligence—are transforming society, industry, and everyday life.

From diverse perspectives including economics, institutions, and culture, the group examines both the opportunities and challenges posed by these technologies. Through international comparative surveys and close collaboration with industry and public-sector organizations, RISING builds evidence grounded in real-world practices.

Amid the rapid evolution of technology, the group addresses a fundamental question: how can humans and society coexist with advanced technologies? By engaging with this question, RISING aims to generate insights and policy-relevant recommendations that contribute to the development of a sustainable and inclusive next-generation information society.

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Cover and Design:	Akiyuki Okada
Illustrations and DTP production:	Willing Co., Ltd.
Editorial cooperation:	Mina Sasaki / Tategumi Inc.
Overall cooperation:	Impress Corporation