

Cybernetic Avatars: Authentication, Notarisation and Regulatory Visions from a Japanese Perspective

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Etymology of the Word 'Avatar'

- Derived from the Sanskrit word for '**Avatara**' (अवतार, Avatara) of Lord Vishnu, avatara means 'incarnation'.
- In the Hindu epics **Ramayana** and **Mahabharatam**, and in the **Pagavad Gita**, one of the Hindu scriptures, Rama and Krishna appear as the protagonists of superhuman beings. Krishna, the avatara (**incarnation**) of Lord Vishnu.
- The word "avatar" was used in the film Avatar, directed by James Cameron, inspired by the words "'representation' (symbolic representation) or 'descent' (descent to earth) of a divine principle, which is the object of people's faith" (Frederick, L, Drucker, M, translated by Yoko Tajima: God, Shunju-sha (2013), p. 115).
- **Mandalas** in Japan, India and China depict Buddhas and deities descending to earth in temporary forms (avatars).
- In Japan, they call them 'Gongen' or 'alter-ego Buddhas'.
- Mandala alter ego Buddhas are described as avatars in US museums and other institutions.

The term 'Avatar'.

- The term is often used to mean "**Alter Ego**" of "oneself", but the original meaning of the term in terms of its origin is "**Alter Ego (incarnation) of God**", not "Alter Ego of natural person".



What is Cybernetic Avatar?

The Term 'Cybernetics'.

- It is said to have been inspired by the Greek word '**helmsman**' (Κυβερνήτης).
- French physicist André-Marie Ampère, in his classification of the sciences, suggested that the still nonexistent science of the control of governments be called cybernetics
- Term also proposed by US mathematician Norbert Wiener

Derivative of 'Cybernetics'.

- 'Cyberspace'.
- William Gibson, Neuro-Mancer.
- The term was coined by combining the words Cybernetics and Space (space). The term is taken to mean 'a wide-area network/communication network that engages billions of people living by everyday standards and provides 'consensual illusions'.

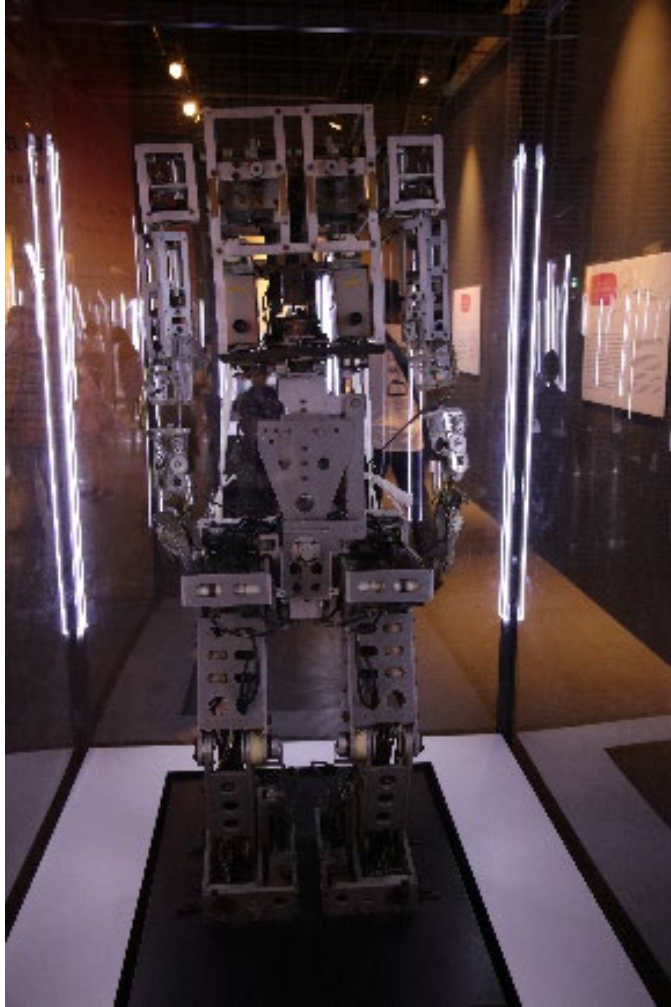
'Cybernetic Avatar'.

- No clear definition exists.

'Digital Twin' and 'Digital Twin Computing'.

- NTT, "Digital Twin Computing Concept to create innovative services by multiplying high-precision digital information reflecting the real world - Innovation platform to create future society by synthesising diverse virtual worlds" (10 June 2019), in Defined as follows.
- **Digital Twin**
 - **A digital twin is digital information that accurately represents the shape, condition and manufacturing process of an object, for example a machine part, in a computer** (Dr. Michael Grieves, Digital Twin: Manufacturing Excellence through Virtual Factory Replication, 2015)
- **Digital Twin Computing (DTC).**
 - **A new computational paradigm that greatly advances the digital twin and enables the free reproduction and experimentation of interactions between objects and people in cyberspace by performing operations such as exchange, fusion, replication and synthesis (digital twin operations) on the many digital twins that represent the real world.**

History of Humanoids in Japan



WABOT-1 1973 (Waseda Univ)
The world's first humanoid intelligent robot.

HRP-1 1999 (AIST)
It can walk on bumpy paths, climb stairs and carry 10 kg of objects.



ASIMO 2000 (Honda)
It can control gravity, jump and play football.

History of Humanoids in Japan



TMSUK04 1999 (TMSUK)
Humanoid tele-operated robot
which can be controlled remotely
via PHS line.

Posy 2001 (SGI)
Created in the setting of a
three-year-old flower girl.



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Partner Robot Harry 2004 (TOYOTA)
This robot can play the trumpet
through delicate mouth, hand, and
finger movements.

History of Humanoids in Japan

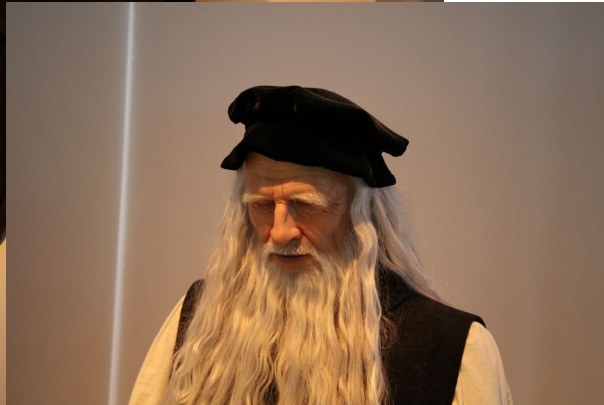
Da Vinci 2015

Italian conversations can be played and backstage operators can pretend to be Davinci and talk.



Soseki 2016

A prominent Japanese writer (1897-1916). Uses the voice of Soseki's grandson. He does readings and commentaries of his own literary works.



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Ishiguro 'Geminoid' 2006~

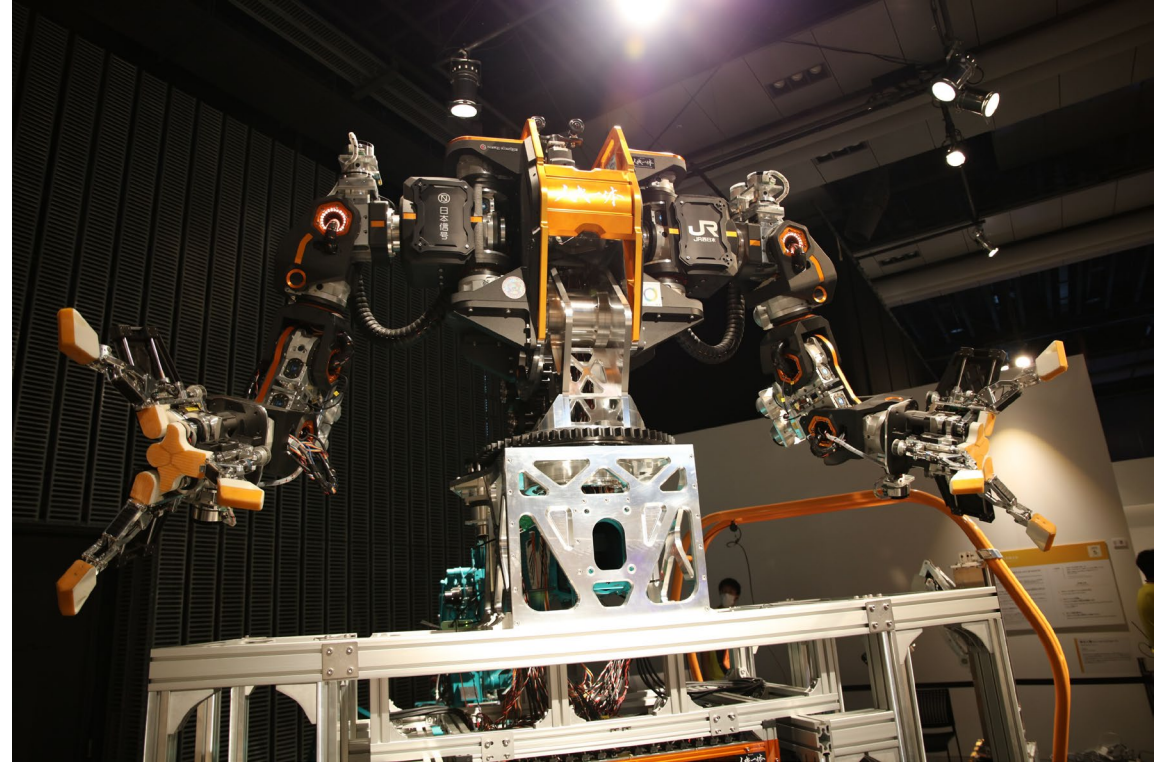
A remote-controlled android that bears a striking resemblance to Professor Hiroshi Ishiguro of Osaka University.

Tele-operated Robots in Japan



T-HR3 2017 (TOYOTA)

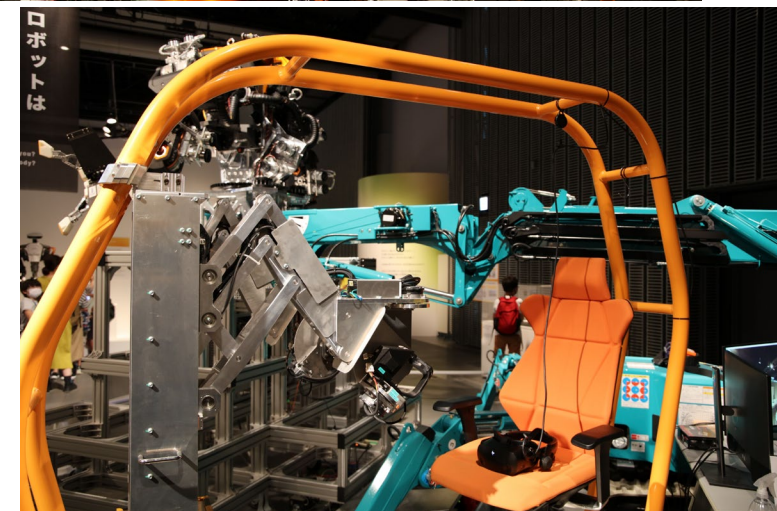
The operator can make the T-HR3 move in the same way as the pilot while feeling the external forces applied to the T-HR3.



Type Zero Humanoid 2022
(NIPPON SIGNAL)

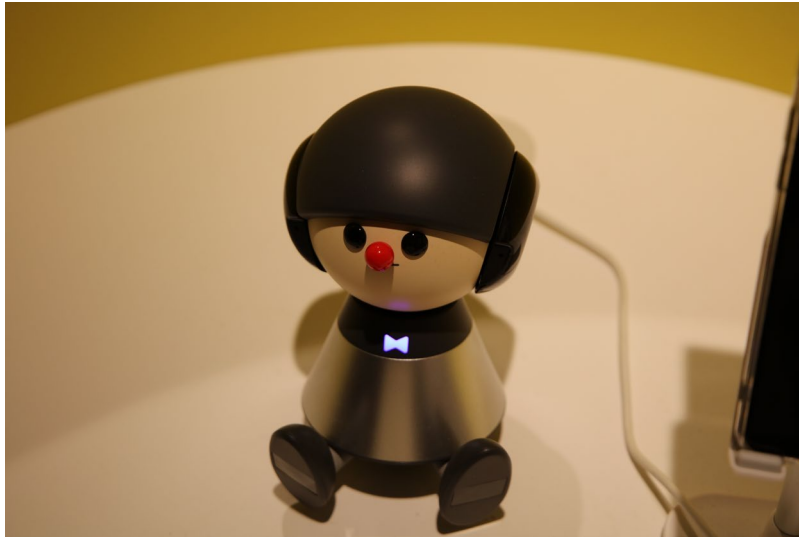
General-purpose man-powered heavy machinery for heavy-duty work at high places.

The operator controls the robot, and the operator can also feel the sensations of the robot.

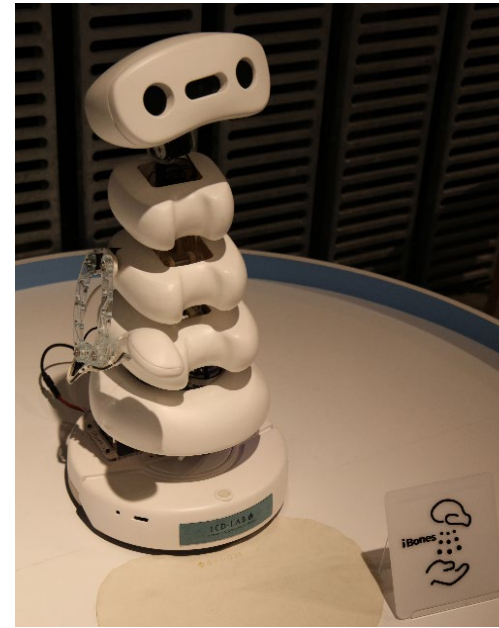


Communication Robots in Japan

waitress robot ' Orihime'



the concept of this talking robot is
'more than a friend and less than a boyfriend'

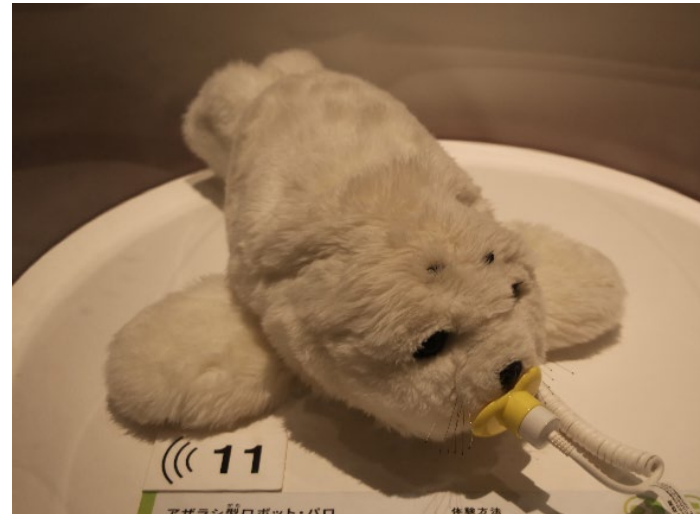


The robot calls for alcohol disinfection in a reserved manner.

a pet robot with warm body heat



garbage bin robot to encourage sorting



seal-shaped therapy robot





- The Japanese Council for Science, Technology and Innovation (CSTI)

The "**Moonshot Research Project** Goal 1" (to realise, by 2050, a society in which people are free from physical, cerebral, spatial and temporal constraints) decided by the CSTI and the "Moonshot R&D System" promoted by the Strategic Headquarters for Health and Medical Care.

Cybernetic avatars are a concept that includes ICT and robot technologies which extend the physical, cognitive and perceptual capabilities of humans, in addition to avatars that show robots, 3D images, etc. as a substitute, aiming to be freely active in cyber-physical space in the Society 5.0 era. It is intended to be a "cyber-physical space in the Society 5.0 era.

[Table 1: Classification of CAs]

Tangible Objects CA	Robots and other physical avatars
Intangible CA	Computer Graphics Avatar Software agents, etc.

'Tangible CA'.

- Robots as 'tangible objects' such as geminoids and humanoids.
 - Avatars consisting of other 'tangible objects (solids, liquids, gases)' are also included.
 - Stealing liquid CA constitutes theft under Article 235 of the Japanese Criminal Code as stolen water.
 - When a CA is projected onto a gas-filled area by projection mapping, the gas CA in question becomes a tangible CA and the projected shadow image becomes an intangible CA in the same way as holography.

Legal Provisions

- Electricity is an intangible object, but is positioned as a property (tangible object) under current Japanese law
 - Article 245 of the Japanese Criminal Code provides that 'electricity shall be regarded as property'.
 - Article 85 of the Japanese Civil Code also provides that 'in this law, "object" means a tangible object'.
 - Until the said provisions were established, they were considered to be the same as tangible objects in accordance with the Electric Theft Judgment (21 May 1903).

The Status of Property in Legal Interpretation

- (1) **Tangible property theory (goods are tangible objects) → (1) Tangible property theory is the prevailing theory.**
- (ii) Manageability theory (intangible objects are also property as long as they are manageable).
- (iii) Physical manageability theory (with manageable materiality).

'Intangible CA'.

- Avatars used in the **Metaverse**
- Avatars in online games
- V-Tuver (Virtual YouTuber)
- Digital twin (real or deceased person avatar)
- Avatars of virtual fictional persons or characters
- Electronic agents and bots

Numerous intangible CAs still exist at present

○ Classification of Usage Phases Testimonials

(1) Situations of use of CAs

- (i) Substitution of a real person
- (ii) Reproduction of a deceased person
- (iii) Representation of a non-existent person

(2) Method of Use

- (i) Remote operation
- (ii) Use within the scope of automatic programme processing
- (iii) Autonomous operation

(3) Research Objectives

- **Cybernetic avatar infrastructure that enables everyone to participate in diverse social activities (a goal indicated by Goal 1 of the 'moonshot-type R&D system').**
 - (i) By 2050, combine a large number of avatars and robots that are remotely controlled by multiple people.
By developing technologies to perform large and complex tasks, and by operating, etc.
Build the necessary infrastructure for
 - (ii) By 2030, more than 10 avatars per person for one task, with the avatars
Develop technology that can operate at speeds and accuracies equivalent to those of a single body, and develop the technology necessary for its operation, etc.
Building the foundation.
- **Specifically CA-based concept "Cybernetic Avatar Life".**
 - (1) By 2050, everyone who wants to will have top-level physical, cognitive and perceptual abilities.
Develop technology that can be extended to the whole of the world and promote a new way of life based on socially accepted norms.
 - (ii) By 2030, anyone who wants to will have the physical, cognitive and
Develop technologies that can enhance perceptual abilities and propose new lifestyles based on social conventions.
Presenting to do

In discussing the legal status of CAs, the following two types of CAs are examined: tangible CAs and intangible CAs, respectively, and **corporate avatars and individual avatars**.

- Legal 'person' includes not only natural persons but also legal entities
- Avatars are neither natural nor legal persons and therefore only have legal status as objects (tangible or intangible) such as machines or software.
- Until some legal personality is conferred on the avatar, its legal status is that of a mere thing.
- Various challenges have to be solved in order to carry out legal acts via avatars

Tangible Objects CA

Legal positioning other than as a thing is inconceivable.

Intangible CA

The concept of law as electronic agent has been examined since the late 1990s (e.g. Ian R. Kerr) 'On Contracts with Electronic Agents'.

- (i) How to grant legal personality to agent software.
- (ii) The method by which the action of the agent software is regarded as the act of the legal entity that uses it.
- (iii) How to refer to the legal status of Roman slaves in ancient times.

(i) How to grant legal personality to agent software.

- The idea that software is assumed to have legal rights and obligations and is equated with other human-created artefacts such as companies.

(ii) The approach of regarding the electronic device as an act of a legal entity that uses the action of the agent software, instead of regarding it as an independent legal entity.

- Ignoring the aspect of the agent software operating spontaneously in the process of concluding an agreement and pretending that it is nothing more than a mere means of communication.
- The way in which the issue has been discussed as a question of the application of '**legal fiction**'.
- For example, the UNCITRAL Model Law Enactment Guide states that 'data messages automatically generated by a computer without human intervention should be regarded as 'originally executed' by a legal entity, instead of being accomplished by a computer.' (emphasis added)
- The Compilation Commentary to Part 2B of the Uniform Commercial Code also states that electronic agent software is, in effect, merely an extension of the human being who uses it, and that his or her actions are constitutive of those of the individual.
- The UETA (The Uniform Electronic Transactions Act) also explicitly recognises electronic devices as mere extensions of human action, but also as capable of operating independently of human control, and the contracts entered into by electronic agent software. Approval.

Besides the application of legal mimicry, there are other ways of extending contract principles in a broader sense

(iii) A reference to the fact that slaves in Roman times were considered to have no legal personality, but many legal rules existed to enable them to participate in trade and to enter into contracts.

Reference to the fact that **slaves in** Roman times were considered to have no **legal personality**, but **many legal rules existed to enable them to** participate in trade and to **enter into contracts**.

That a certain similarity in legal status can be recognised in electronic devices that voluntarily carry out transactions with Roman slaves, and that once the certainty of this technology is ensured and a high degree of autonomy and intelligence is brought to the fore, it will **provide sufficient reason to treat it as a legal intermediary** rather than a mere tool. (2) Those that are considered to be

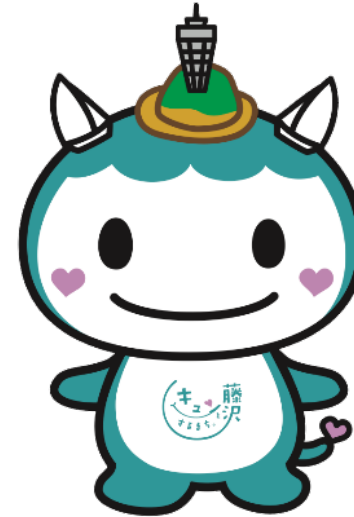
○ Corporate Avatars

In Japan, both tangible and intangible characters are present and active in promoting and understanding local government and various laws.

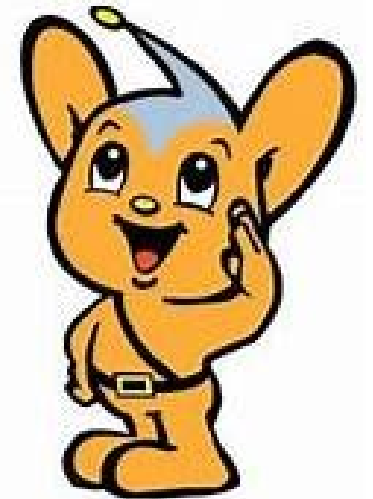
- So-called 'stuffed animals'.
- Virtual Avatar.
- A wide variety of avatars are used on a daily basis.
- Japan is one of the leading avatar societies.



YouTube: My number card application form with QR code - now being sent!
(Myna-chan, Minister Hirai explains about the My Number Card, vol. 2)
(16.2.2021).



Fujisawa City character Fujikyun



Peepo-kun, Official character of the
Metropolitan Police Department

- **The use of corporate avatars as legal entities to perform legal acts is**
Can you say that this is not envisaged in the future?
 - It may not be a good idea to discuss legal acts by corporate CAs in future CA development
 - (e.g.) Chiba Prefecture mascot CHI-BA+KUN, an avatar personifying Chiba Prefecture.
 - It is not envisaged that Cheeba-kun will perform legal acts relating to Chiba Prefecture on behalf of the Governor of Chiba Prefecture.

Example of a hypothetical situation

In the granting of subsidies for prefectural projects, the Governor of Chiba Prefecture shall ensure that the grantee organisation concerned, which is the grantee of the subsidy, is

The term “representative” is defined in Article 108 of the Civil Code as a representative of both parties.

to delegate the powers of representation of the chairperson of the relevant association to the chairperson of the association and follow the procedure for dissolving the bilateral representation.

Is it possible to do so?

While there are many situations where the legal entity avatar is used in factual acts, legal acts relating to legal entities

Is it necessary to consider the possibility of using a corporate avatar to do this?



Personal avatars

- The relationship between the individual CA and the CA concerned used by the individual CA.
- Individuals in relation to personal CAs are 'the person'
- Avatars are not 'people' at the moment.
(In legal terms, 'persons' are natural and legal persons).
- If a **legal entity is** granted in the future, it could be positioned as a 'person'.
- An avatar who is not a 'person' cannot be a proxy.
- The positioning of electronic agents as agents has been discussed.

Relationship between the principal and the tangible object CA

Attempt to define the CA pertaining to the person as the 'body' (alter ego (avatar))

Why we think it is necessary to define 'the person' and 'the body' separately

- Necessary to develop mechanisms and technologies to allow for 'identity-mimicry', whereby the avatar's actions are deemed to be those of the person in question.
- Information that identifies a person is '**personal identifiers**'.
- Information identifying the CA of the person concerned is '**body identification information**'.
- Information that identifies the identity of the CA concerned is '**personal identifiers**'.

Forms of use of personal CAs

- Use by third parties other than the individual and simultaneous use by multiple CAs is possible.

Individual CA users

(i) the individual or (ii) a third party.

Number of individual CAs

(i) one body or (ii) several bodies.

Personal CAs subject to use.

(i) the body of the real person, (ii) the body of the real third party, and (iii) the body of the real person.
(iii) the body of the non-existent principal; (iv) the body of the non-existent third party.

Explicit CA

- An attempt to examine the mechanism for extending the manifestation principle referred to in Article 100 of the Japanese Civil Code in the development of the "manifestation CA".
- The "extended eponymity principle" (Triologue) means that it is necessary to consider an eponymity principle that not only indicates that the person is an agent with power of representation, but also includes the meaning of eponymity to indicate that the person is the "principal" as an agent avatar of the principal.

Anonymous CA

(i) Linkable Anonymous CA

- Avatars that cannot be used to identify a specific individual by the avatar in question by the standards of the general public, but whose avatar can be identified to the entity that manages the avatar.
- The CA concerned is different from the individual in appearance and does not need information (existence) such as a face in the first place, but must be linked to a specific individual and have a mechanism in place to identify that individual.

(ii) Unlinkable Anonymous CA

- Avatars whose identity cannot be identified by the general public, nor by their administrators or their user-agents, and who are not in a position to identify the identity of the CA concerned.

2022

2030

2050



Third Party

CA Authentication Infrastructure

CA Certification Authority

User Authentication

Continuous Certification

Multi-Factor Authentication

Identification and Authentication of CA

Continuous Certification

Notarisation of CA

CA certification and notarisation infrastructure
Authentication code management

Data Subject

Authentication of the Principal

Notarised CA

Authentication of CA

Avatar (Artifact) Biometrics (AB)
(i) Authentication Device use type AB
(ii) Perceptual Awareness type AB

Notarised CA which authenticate the identity of the person



(1) Memory

(something you know)

Identification code (e.g. PIN, Password)

(2) Tangible Objects

(something you have)

Keys, Cards and Devices

(3) Biometrics

(Something you are)

Multimodal Biometrics

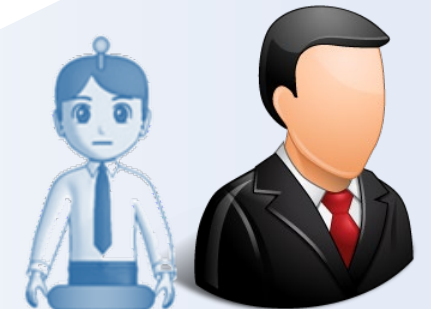
Personal Identification Technology

Cross-modal Biometrics



Notarisation of CA

- Lifestyle Authentication
- Turing Test for CA
- Technology for automatic identification of authorised and unauthorised CA
- Technology to prevent reverse



Establishment of CA Authentication and Notarisation Infrastructure and Legal Issues

KYC (eKYC) and information security

Authentication topology configurations suitable for CA using graph neural networks (GNNs), etc.

Establish detection mechanisms for illegal code and execution instructions.

Technical mechanisms for accountability and non-repudiation of the legitimacy and basis of the trail.



Unauthorised CA, CAs of UFO (Unidentified Fabricated Objects)

- ELSI (Ethical, Legal, Social and Economic) issues
- Legal Issues of AI, Robot and Avatar
- Policy development of CA research and development (policy advocacy, intellectual property protection, international strategy and standardisation)
- International strategic policy development of CA R&D.

ELSI Research Infrastructure and Policy Development

(i) Avatar life and added value

- Realisation of added value such as spiritual enrichment and comfort using CA is an important factor.

'Unidentified Fabricated Object' (UFO).

Omnipresence of 'unidentified fab avatars (tentative name) (UFO avatars)'.

Authorised CA ('Authorised CA', 'ACA') certified in accordance with the CA Certification Infrastructure and Human Oversight international standards.

Society can now use the ACA safely in the event of UFOs



Transformation of identification procedures for the construction of the Avatar Authentication Infrastructure.

Enables identification of natural persons using CAs.

The construction of the CA authentication infrastructure is nothing less than the construction of a new identification and authentication infrastructure that will fundamentally overturn the common sense of identification procedures.

In 2050, we will move from the era of 'we authenticate avatars' to the era of 'avatars authenticate us' (My Number Avatar Authentication System).

1 Pillars of research for this research and development project

A prerequisite for the safe, secure and trustworthy use of CAs in everyday life is the establishment of an 'authentication infrastructure' to guarantee their reliability.

Develop new continuous authentication technology (Continuous Authentication) to ensure continuous and continuous connectivity between CA user entities and the main body CA by 2030.

Examine the institutional issues required for CA certification infrastructure and certification code management in order to develop a CA certification mechanism to operate the CA certification infrastructure in the future.

Research and policy development on ELSI issues that need to be overcome to realise a living environment where people can use CA in their daily lives and to ensure social acceptability.

(i) Authentication of the CA operator (the person or other user subject) (**user authentication technology**).

(ii) Identification and certification of CAs (**CA certification**)

(iii) Guarantee of connectivity and existence of the operator and the CA itself (**CA notarisation**).

(iv) Development of new dimension area jurisprudence (AI, robotics and avatar law) and establishment of ELSI research infrastructure.

(v) Policy development of CA R&D (policy advocacy, IP protection, international strategy and standardisation)

- Situation of CA use (real, physical, non-real) / Method of use (remote control, automatic processing, autonomous operation) / Form of use (single, multiple, explicit, anonymous).
- Research on complex and structural ELSI issues according to tangible or intangible CA

Avatar Life and Added Value

A society with a high degree of cyber and physical convergence in 2050.

CA living environment that is safe and secure for CA and widely available to the public



Realisation of added value such as spiritual enrichment and comfort using CA is an important factor.

Digital fabrication technologies such as 3D printers and laser cutters make it easy for anyone to manufacture tangible CA

Widespread use of inexpensive and easily accessible low-cost CAs

As genome analysis technologies become readily available, the provision of DNA and CA linkage business is envisaged.

Growing need for high-functionality, high-end, high-grade CA as a symbol of affluence and comfort.

Prerequisites for enjoying added value

Unidentified 'unidentified manufactured goods' (provisional name).

'Unidentified Fab Avatar'.

Coexistence with Unidentified Fabricated Objects (UFOs)

CAs generated and manufactured in large numbers by 3D printers.

Shoddy CAs or CAs of unknown manufacturer or manager.

Use of 'authorised avatars' (Authorised CA (ACA)) certified in accordance with the CA certification infrastructure and Human Oversight international standards.

Society can now safely use the ACA even if UFO avatars appear.

Limitations of Capacity Expansion and ELSI Issues

High-performance, high-definition CAs that enable an extreme experience of human capacity expansion.



Increased risk of theft and destruction due to envy.



Security measures aimed at preventing theft of goods are not enough.

Objects of attachment as their own alter egos

Social demand for protection that goes beyond the mere treatment of objects.

CA Protection similar to that of natural persons, such as kidnapping and injury.

Capacity expansion through the use of the ACA is
To what extent is this socially acceptable?

together with the alignment with ELSI issues.
Is the generation of new social norms necessary?

By using the ELSI Subject Research Platform.
Responding to unknown challenges

Examples of technologies planned for research to build the CA notary infrastructure

Lifestyle authentication technology

- Automatic detection of behavioural and activity changes caused by changes in the CA operator.

Turing Test for CA

- Check the behaviour of the CA to ensure that the operator has not changed from a human to a rogue program.

Technology for automatic identification of authorised and unauthorised CAs.

- Dealing with the creation and misuse of non-authorized CAs similar to authorised CAs, such as celebrity inanimate CAs.
- Compared to non-authorized CAs, in the construction of authorised CAs it is possible to obtain the cooperation of the individual and use a myriad of sensors. Consideration of 'micro-identifiers' focusing on this asymmetry.

Prevention of reverse CA

- Technology to enable the detection of fraudulent reverse creation by non-authorized CAs from authorised CA data, e.g.



Key Issues to Overcome
Social challenges
(social acceptability, regulation,
economic viability)

Development of New Dimension Area Jurisprudence (AI, Robot and Avatar Law) and Establishment of ELSI Research Infrastructure

Comprehensive research on legal issues relating to the use of CA in the 'cyber-physical era (CPS)', where cyber space (virtual space) and physical space (real space) are highly integrated and coexist.

Conduct research based on the four disciplines of ethics (E), law (L), society (S) and economics (E).

Research on **ELSI issues from a** new ELSI perspective, issues that cannot be envisaged within the current framework and issues that require new concepts to be presented or constructed in the future.

ELSI research system (sustainable ELSI research infrastructure for 2050)

Encompassing

Looking Forward

Systematical

Integrated

Issues which Need to be Resolved for Social Implementation of CA.

- Examination of the challenges associated with complex, multiple and transcending temporal and spatial constraints activities that deploy CAs that can be operated remotely or autonomously in real space as well.

Avatar Life and the Avatar Law

- Fostering 'avatar law' as a field of law that deals with social norms and legal issues to be observed when operating in CA, one's alter ego, both in real space and in the metaverse.

Paradigm Shift towards the Construction of Concepts in New Legal, Ethical, Social and Economic Issues

- Reconsideration/review of basic legal and social concepts (e.g. "What is the person?" and "What is attendance?") Also challenges the
- New concepts associated with the change from a physical and fixed state of existence by natural persons to a variable and time-dependent state of existence by CA use.

Current Issues

- The study of the so-called ELSI issues has been closed to research in the humanities and social sciences and aimed at finding ways to solve them.
- It is necessary to show how those new challenges can be solved with 'technology'.
- The comprehensive research system of ELSI issues (ELSI in this proposal) necessary for this purpose has not yet been established.

Policy Development of CA R&D (Policy Advocacy, IP Protection, International Strategy and Standardisation)

Requirement for Establishing CA Certification Infrastructure
Standardisation and other Institutional Responses

Implementation of Policy Development

Challenging ELSI Issue Research on CA

There is no situation where IP protection strategies from an economic security perspective are recognised as a sensitive issue in CA development.

Need for careful and strategic international deployment of emerging technology developments related to CA, taking into account the measures required for sensitive technology control under the security trade export control system.

There is no situation to consider the international deployment of results from CA research and development in areas that cannot be addressed by the studies in this proposal, such as applications to lethal autonomous weapons (LAWS), after keeping a close eye on the trends in the international community.

With regard to international rule-making, while efforts are being made to formulate principles for research, development and use of AI, the study of legislation and other issues related to CA is an area that has not yet been started.

International standardisation efforts are still under consideration

Policy Recommendations on the Systems Needed to Consider the CA Certification Infrastructure

International Strategic Policy Development of CA Research and Development.

- International development in the context of economic security and security trade export controls.
- International emerging sensitive technology management systems and CA R&D.

Initiatives on CA Infrastructure and International Rules of CA life

- Recommendations necessary for making strategic rule-making in order to promote international co-operation at the stage when CA is internationally widespread in 2050.