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Authentication of Cybernetic Avatars and Legal System Challenges; With a View to the Trial Concept of New Dimensional Domain Jurisprudence (AI, Robot, and Avatar Law)

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Keywords

cybernetic-avatars, ELSI, authentication, law, privacy

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Abstract

This article aims to illustrate the basis for the development of authentication, which will be the foundation of future cybernetic-avatar (CA) infrastructures, enabling the safe and secure use of CA's. This will be realised by the authentication of CA operators (User Authentication Technology), identification and authentication of CA's (CA Authentication), and ensuring connectivity and existence between operators (User Entities) and the CA's themselves (CA Notarisation). An ELSI (Ethical, Legal, Social Implications) research platform will be established, to develop a new dimension of the legal field, that is, AI, Robot, and Avatar Law to solve the social issues and realise an avatar lifestyle.

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1. What is a Cybernetic Avatar?

'Cybernetic Avatar', (hereafter referred to as 'CA') has no clear definition at the time of this study. The term 'Cybernetics' originates from the ancient Greek term 'Κυβερνήτης', (kybernetikos), (steering).¹

The term was first used by the French physicist André Marie Ampère in the first half of the 19th century in the following context. In his treatise on 'The Goavernance of Administrative Districts', he used the term in an attempt to derive a general law of control by taking 'control' as a purely abstract concept detached from its object'.² Incidentally, Ampere was a physicist who presented Ampere's Law, which showed the relationship between electrical currents and magnetic fields. The unit of measurement for electric current, Ampere, named after him, is familiar to us.

Later, in 1948, American mathematician Norbert Wiener used the term 'Cybernetics' in his book.³ Wiener refers to an 1868 article by the British physicist, James Clerk Maxwell, discussing the 'Governor',

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1 Stuart Umpleby, *Definitions of Cybernetics*, American Society of Cybernetics <<https://ascybernetics.org/definitions/>>(1982; revised 2000).

2 Saburo Akabori, 'Cybernetics and Sociology in Postwar America', *Economy and Society* (Bulletin of the Tokyo Women's University Sociological Society), vol. 37 (2009), p. 30.

3 Norbert Wiener, *Cybernetics: or Control and Communication in the Animal and the Machine*. Cambridge, Massachusetts, MIT Press (1948).

a mechanism which autonomously regulates the speed of motion of a rotating machine, and points out that the term Governor is derived from the same Greek word from which the word Cybernetics is obtained.⁴ Additionally, a derivative of 'Cybernetics' is 'Cyberspace', a term coined by William Gibson in 'Neuromancer',⁵ which combines the words 'Cybernetics' and 'Space'.

In Japan, the Council for Science, Technology, and Innovation (hereinafter referred to as the 'CSTI') and the Strategic Headquarters for Health and Medical Care jointly promote an 'M Moonshot R&D System'. The Moonshot Goal 1 determined by the CSTI, 'to realise a society in which people are free from the constraints of body, brain, space, and time by 2050', provides the following commentary on CA research and development:

'Cybernetic Avatars are a concept which includes ICT and robotics technologies which extend a person's physical, cognitive, and perceptual abilities, in addition to avatars which show robots, 3D images, as a substitute, and which are free to operate in a cyber-physical space in the Society 5.0 era'.⁶

2. Need for 'Identification' of Cybernetic Avatars

Regarding CA's, it is impossible to use avatars as trustworthy entities in a society if it is impossible to recognise 'whom' the CA is. It is impossible to realise social activities such as contracts and negotiations with unidentified avatars via a CA.

To daily use CA's safely, securely and reliably, it will be necessary to consider and build an 'Avatar Authentication Mechanism' to guarantee their reliability. Simultaneously, it is essential to build an Authentication Infrastructure for identifying avatar use. Accomplishing this requires the development of a new Continuous Authentication technology, (continuous authentication) to guarantee continuous linkage between the operator and the CA.

When building an authentication and certification infrastructure, it is necessary to consider the entities which will operate the CA certification infrastructure. Furthermore, the technical and institutional issues required for the CA certification infrastructure and certification code management must also be considered, to develop a CA certification mechanism in the future.

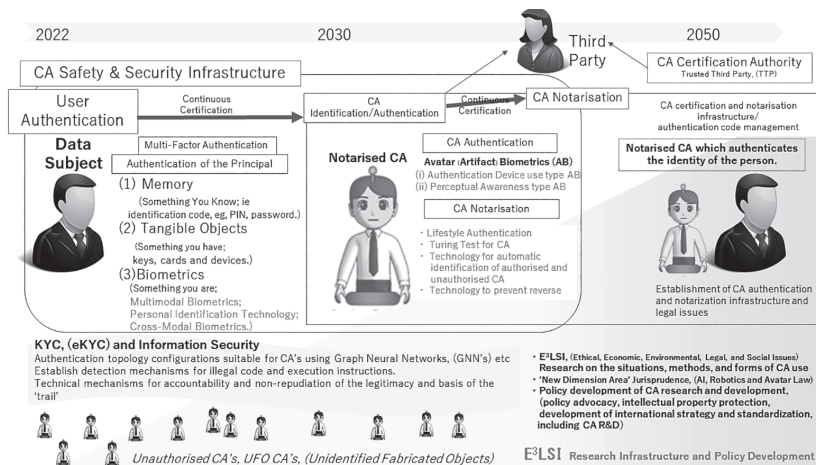
To achieve this, it will be necessary to conduct research on (i) authentication of the CA operator (the person or other user entity, i.e. user authentication technology), (ii) identification and authentication of the CA (CA authentication), and (iii) ensuring the connectivity and existence of the operator and the CA itself (CA notarisation).

4 Britannica, cybernetics, <<https://www.britannica.com/science/cybernetics>>.

5 William Gibson, *Neuromancer*, Ace (1984).

6 National Science and Technology Agency, 'Realised with cybernetic avatars, freeing the body, brain, space and time from constraints'. JSTnews2021(9), PP.12-13.

(Figure1: Conceptualisation of user CA authentication and CA Notarisation).



3. Avatar Law as a New Dimension of Area Jurisprudence

3.1 What is New Dimension Area Jurisprudence?

Starting with the research and development of CA's and the consideration of issues for their future use, society and the legal system will have to change from an era in which Cyber Space, (Virtual Space) and Physical Space, (Real Space) have existed as separate spaces, to a 'virtualised real world' in the 'cyber-physical era' in which the two are highly integrated and coexist. Therefore, the society and the legal system have had to undergo a transformation. It is necessary to address issues which cannot be addressed by conventional legal interpretations and current laws and regulations.

3.2 Avatar Law

The use of CA's in the Cyber-Physical Era will not be able to be implemented in the society without consideration of the legal issues regarding complex, multiple and transcending, temporal and spatial-constraint activities which deploy remotely operated or autonomously operating CA's.

To date, the law has fostered social norms for a single real space and its associated virtual space, which are based on the personality of a single individual at the same timeframe. In the future, diverse Meta-Verses ('MVs'), to which different norms apply, will exist simultaneously. In conjunction with this, an environment will emerge in which multiple CA's will be able to act as avatars for the individual, and a society will be created in which multiple activities can be developed by the individual's alter ego. Online games may already be played with avatars, and currency which can only be used in a specific virtual space, is used. Thus, a fictional world is established according to rules which differ from those of real space. However, in this situation, there is no real harm other than disadvantages such as losing the game if the rules are not adhered to. However, MV's and CA's are not fictional worlds, as are games, but rather aim to function as real-world worlds, which extend our daily lives by merging virtual and real spaces, so the problems that arise may have various seriously negative effects on our social lives. Avatar law is a field of law which deals with the social norms and legal issues which must be observed when the CA acts as the individual's alter ego, in both MV and real space.

Given this paradigm shift in legal concepts, we must also consider the challenges of reconsidering and revising basic legal and social concepts. This paradigm shift in terms of the construction of new concepts must be examined considering the divergence in understanding from current concepts, as a result of 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.

The specific legal issues to be considered in the Avatar Law will be studied in our future research. One example is whether avatars with the same or different appearances as the person in question can be granted portrait rights or publicity rights when they are used in social life as a substitute for the person in question.

Various 'objects' may be traded in Virtual Space, but there is also the question of whether ownership of 'objects' can be established in such a space. Various items and avatars may be acquired by paying charges based on their abilities and experience levels. However, the current legal interpretation does not clarify whether ownership or property rights have also been established.

4. Transformation of Identification Procedures

The use of avatars in society requires authentication of the 'avatar'. In other words, it is necessary to authenticate an avatar using identity and CA verification procedures. Once a system or information system infrastructure for authenticating avatars is established, it will become possible to 'authenticate users' who 'employ' a particular avatar and to 'authenticate other CA's'. Currently, there is no difference between the procedure for confirming the identity of a person using memory, possessions, or biometric information, and a system for authenticating the person who is authorised to do so using keys, IC(Integrated Circuit) cards, or biometrics, when entering or leaving a room.

However, if it is possible to construct an authentication infrastructure that can continuously authenticate CA's and their users, it will be feasible to confirm the identity of natural persons using CA's as a revolutionary process within identification procedures. The construction of a CA authentication infrastructure implies that such a construction, which fundamentally overturns the common-sense identification procedures, can be realised. It is thought that the reality is we are moving from an era in which 'we authenticate avatars' to an era in which 'avatars authenticate us'. However, it should be noted that there is a possible problem, in that, the avatar will have the same functionality as a 'possession authentication' mechanism, such as authentication using, for example, a key or IC card for identification, which may be used illegally if that avatar is stolen.

In addition, if the entity managing the avatar authentication infrastructure is a public institution, the State can reliably manage, (monitor) the 'person' authenticated via the avatar. The spread of CA's, which may also manage the public as mobile surveillance tools, may considerably advance the Surveillance Society; therefore, careful consideration of the avatar authentication mechanism is required from the perspective of guaranteeing the right to privacy.

When a certification mechanism is established by a public authority, with the trustworthiness of the

certification infrastructure as the primary concern, individuals who are certified by the CA may file a 'CA Certification Infrastructure Unconstitutional Lawsuit' against the State, or other public authorities, demanding the removal of their certification code from the CA certification infrastructure, as a claim for Exclusion of Interference, based on infringement of personal rights, such as the violation of privacy.

Thus, the above confirms another important issue for the Avatar Law: that is, to consider the appropriate type of authentication infrastructure from the perspective of privacy protection, such as building the CA authentication infrastructure, not as public infrastructure under state control, but as one without a centralised management entity, for example, by utilising Blockchain Technology.

5. Existence of Unidentified Avatars

As the number of situations in which avatars are used in social life increases, we will need to consider life and value-added avatar use. Specifically, it is assumed that in a future society where cyber and physical life are highly integrated, and where CA's are used safely and securely, and a 'CA Living Environment' is widely spread among the general public, this realisation of such added value, as 'mental richness and comfort' using CA's will be an important factor.

Such a social environment will be achieved through the spread of inexpensive and readily available low-cost CA's, where anyone can easily manufacture tangible CA's using digital fabrication technologies such as 3D printers and laser cutters. Notably, as the need for high-performance, high-end, and high-grade CA's increases as a symbol of affluence and comfort, the pre-requisite for enjoying such added value must surely be how to coexist with 'Inferior CA's' and 'Unidentified CA's', evidently with no identifiable manufacturer or manager, and in some cases with complete autonomy.

Unidentified Fabricated Objects (UFO) Avatars are being manufactured, and as such, they will inevitably become commonplace within society. Thus, there will be a risk that UFO Avatars may become ubiquitous, and therefore, such ubiquity may cause the above-mentioned complexities; simply because UFO avatars are avatars whose users cannot be identified. Inevitably, criminals can be drawn using this technology.

Indeed, there have been countless cases in which goods and services have been provided using insufficient and incomplete identification procedures, which have caused problems when used in illegal and fraudulent activities. For example, in the past pre-paid mobile phones were sold without the need for any identification of the users of the handsets; and even presently, there is no end to the number of crimes, including bank transfer fraud, committed by so-called Skip Phones, which are contracted in the name of another person or under a fictitious name, to take advantage of the fact that they cannot be traced.

In response, the Law for the Prevention of Improper Use of Mobile Phones has been enacted, requiring the identification of subscribers and prohibition of fraudulent transfers. Similarly, for CA's, along with the construction of a technical authentication infrastructure, it has been necessary to develop legislation to prevent the use of 'UFO CA's' in the 'Surface Society'.

6. CA Certification and Institutional Challenges

6.1 Issues to Consider Regarding CA Certification

CA Certification refers to the technology and system which we have in mind to certify CA's. However, such certification using the 'CA Certification Organisation' has not yet been brought up for consideration, and studies to ensure the social acceptability of CA use, have not yet begun. Therefore, it is necessary to: (i) start examining the institutional issues required to build a new identification and authentication infrastructure for the use of 'CA Avatars, (Authenticated Avatars)', design a CA Authentication Infrastructure and authentication code management mechanism which guarantees the right to privacy of individuals and (ii) seek to ensure social acceptance of the realisation of 'CA Life'. Accordingly, it will be necessary to examine the issues necessary to ensure social acceptance of the realisation of a CA lifestyle.

6.2 Legal and Governmental Institutional Challenges regarding CA Certification

Regarding the institutional issues necessary to establish a new identification and authentication infrastructure, the central issue is the establishment of an all-inclusive CA Authentication Infrastructure. Therefore, the system should be based on the institutional elimination of highly privacy-invasive systems, such as infrastructure linking DNA and CA's.

6.3 Social Inclusion

It is also necessary to consider the main challenges which must be overcome to realise a socially inclusive living environment in which CA's may be used daily. Research must be conducted on complex and structural legal issues, focusing on the type of CA use (real, physical, or non-real), method of use (remote control, automatic processing, or autonomous operation), form of use (single or multiple, explicit or anonymous), and tangible or intangible CA performance. By way of elaboration, if multiple CA's can be operated by a single police officer, the number of police officers engaged in criminal investigations and crime prevention activities can be increased, and if individuals can be authenticated by their avatars, an ultimate avatar surveillance society can be realised. Thus, in principle, a safe CA society can eradicate crime. However, we would need to consider whether such a panopticon-like CA surveillance society, in which humans would be constantly monitored by CA's, would be a happy society for humanity, and indeed, what a safe CA society should look like.

7. Proposals for New ELSI, (Ethical, Legal and Social Implications) Considerations

7.1 What is the Role of ELSI Research in Ensuring and Maintaining the Social Acceptability of CA's in Avatar Life?

To realise life with avatars, the consideration of ELSI issues within human society cannot be avoided. Unfortunately, examination of ELSI issues has been confined to research in the Humanities and Social Sciences. The author is arguing that we may solve these new issues with 'technology', and thus it will be essential to establish a comprehensive and collaborative research system for the ELSI issue. Indeed, a new research vision is needed that can deal with the complex and diverse ELSI issues which will be a feature of avatar life beyond our wildest dreams.

It is currently impossible to examine issues that may or may not arise in the future within the framework of current knowledge, society, and institutions. Although the research on ELSI issues associated with the new technological developments has been conducted, we have a situation in which

our current fragmented research is being conducted quite separately. This is partly because of non-collaborative research methods in the Humanities and Social Sciences. Consequently, the lack of an interconnected research system/research method for fundamentally examining essential issues has been a factor in the lack of significant progress in ELSI research.

7.2 CA R&D and the Legal System

In areas such as data management, information security, quality assurance, and environmental protection, initiatives are based on a 'by design' approach, in which mechanisms and measures are designed in advance to achieve targets and standards for the establishment of management systems are also being developed.

For example, a Privacy Impact Assessment (PIA) is a method for assessing matters that need to be confirmed in advance from the perspective of privacy protection and the impact of a privacy breach. In Japan, PIA has been introduced as a 'Specified Personal Information Protection Assessment' under the Number Utilisation Act, while 'privacy by design' and 'privacy by default' have been specified within the EU GDPR system. Regarding the research and development of CA's, before realising social implementation, it is important to refer to such an assessment method and consider their social impact in advance.

CA research/development and the legal system should consider the following: proposals for a legal system necessary for the establishment of a CA certification infrastructure; overcoming unnecessary reflections on the absence of a law (i.e. the disadvantages thought to be caused by the absence of a legal code to regulate and discipline the use of new technologies); issues associated with information acquisition and analysis; guidelines and other rules and regulations; and mechanisms to ensure transparency. In addition, it is necessary to ensure the 'portability' of CA's, (i.e., the seamless transfer of data necessary for CA use), and to consider systems for such portability and for sharing mechanisms within the use of the CA itself.

7.3 Expanding CA Function and Improving Productivity

The purpose of using CA's is, for example, to enable an individual to operate and use multiple CA's to increase the activities that an individual can perform in multiple locations, or to realise those activities that he or she is incapable of carrying out. Such an increase and extension of the CA function is also expected to increase productivity within the organisation to which the individual belongs and within society in general.

There is also potential not only for the extension of individual activities but also for the use of CA's as a non-contact and tele-operation technology by remote control. For example, 'business continuity' and 'ensuring, (maintaining) productivity' may be achieved as a continuation of activities using CA's, even in environments where people must coexist with infectious diseases. Another example of the usefulness of CA's is that of CA use and ensuring productivity as the fulfilment of a statutory employment rate optimum, based on the 'Law for the Employment Promotion of Persons with Disabilities', (in the workplace).

8. Economic Security and CA R&D

8.1 Issues Necessary to Promote CA R&D and to Develop Policies for Social Implementation

To use CA's safely, securely, and reliably in daily life, it is necessary to construct an Authentication Infrastructure to guarantee their reliability and develop new continuous authentication technologies to guarantee connectivity between the CA user and the CA. In addition, it is essential to implement legal institutional measures, such as continuous authentication standardisation and domestic and international policy development, which are necessary for the construction of such certification infrastructures.

The R&D of emerging technologies is an area in which countries compete with each other, and new technological developments must be appropriately considered from the perspective of economic security. As an 'IP protection strategy' from the perspective of economic security, it is imperative to recognise the protection of these emerging technologies in CA development as a sensitive issue. However, while it is necessary to actively promote international collaboration as an opportunity to promote challenging ELSI issue studies on CA such as those described in this study, the hasty, ill-researched provision of information should be discouraged.

Regarding the development of emerging CA technologies, careful and strategic international adoption should also be examined, considering the measures required to avoid the unwanted leakage of sensitive technological information via the Security Trade Export Control System. Contrastingly, efforts should also be made to look at the international deployment of the results of CA research and development, while keeping a close eye on the trends in the international community in areas such as the application of CA's to Lethal Autonomous Weapons (LAWS), which Japan has been hesitant to even consider because of its post-WW2, militarily restricted background.

9. Cybernetic Avatar Certification and Conformity Assessment

Finally, some references should be made to the question of 'who' and 'how' authentication is carried out in the development of the CA authentication infrastructure.

As for the question of 'who' performs this authentication, the degree of impact on individual privacy differs depending on whether the public or private sector performs the authentication, as described in this study, and this is an issue for the future. As for the question of 'how' this is to be done, the EU's AI Act, ('Proposed AI Harmonised Rules'), which is under consideration by the EU, provides a clue to this question.

The 'Proposal for a Regulation of the European Parliament and of the Council on establishing a Harmonised Regulation on Artificial Intelligence, ('The Artificial Intelligence Act') and the amendment of the relevant legislation', ('The Proposal for an AI Harmonised Regulation') was published on 21st April 2021. This has established regulations for the use of AI systems, including bans on their use, depending on their risks. It aims to establish new harmonised legislation by extending the same product safety regulatory obligations traditionally imposed on manufacturers and importers of products to the EU market to AI systems classified as high risk, making them subject to CE marking, and establishing a conformity assessment and third-party certification system for this purpose.

The most important aspect in understanding the intent of the new AI regulatory strategy is that it imposes new procedural obligations which must be complied with before 'high-risk AI systems' can be made available in the EU market. Ex-ante regulations include (i) a conformity assessment, (ii) signing a declaration of conformity, and (iii) the implementation of CE marking. Additional safeguards related to ex-post supervisory and regulatory procedures include (i) registration in an AI database, (ii) post-market monitoring, and (iii) incident reporting obligations.

Together with the Draft Regulation, Machinery Directive (2) will be amended into Machinery Regulations (3), and other related legislation will also be developed. While the Draft Regulation focused on addressing the safety risks of AI systems, new Machinery Regulations aim to comprehensively guarantee the safety of AI systems used in machinery in general. The enactment of the Harmonised Regulations for AI and the amendment to the Machinery Regulations also require operators to conduct a 'conformity assessment' for AI systems.

About the method of CA certification, along with the structure of the certification infrastructure and the management system for certification codes, a system for the certification of 'Tangible and Intangible CA's' and a 'confirmation procedure' that allows them to be used safely and securely will be indispensable.

Confirmation procedures such as the vehicle inspection system are considered effective for the safety of tangible CA's, whereas for intangible CAs, the use of technology to prove that it is not a 'fake' will be effective. The study of evaluation methods which enable them to conform to certain standards and be used safely in society is an important issue.

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