Digital Twins and the Doctrine of Identity: Reimagining Legal Personhood and Representation in the Age of Virtual Replication

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Abstract

As digital twins utilized in numerous developing industries, it is important to address the legal considerations around their creation and deployment as they become more prevalent. With the advent of human digital twins, precise virtual replicas that are capable of mirroring a person's behavior, biometrics and decision patterns, existing legal doctrines are facing substantial challenges. In this paper, we discuss how digital twins disrupt the traditional Doctrine of Identity. This study raises questions about the scope of legal personhood, representation, and liability in virtual environments. The legal frameworks governing privacy, consent, data ownership and personality rights are insufficient to deal with fraud and identity manipulation. In this research, gaps in cyberlaw, data protection statutes and digital identity jurisprudence are evaluated through an interdisciplinary legal analysis. Digital ecosystems must be protected by new legal safeguards that protect autonomy and prevent misuse of human likeness. Virtual representation boundaries, accountability standards and consent requirements are outlined in this rights-based regulatory framework. The goal of this study is to reimagine how modern law should evolve in order to govern digital twins and preserve the integrity of legal identity.

Keywords: Digital Twins, Doctrine of Identity, Legal Personhood, Virtual Replication

1. Introduction

It is significant to address the legal issues surrounding digital twin design and their implementation as digital twins gain traction in developing sectors. The boundaries of existing legal doctrines reshaped through the ability of human digital twins to mimic real-world decisions and identities [1]. From initial design to long-term maintenance, objects and systems can be tracked and analyzed with digital twins. In order to predict and analyze the performance of asset, digital twins can integrate external processes and variables. The virtual model consistent with real-world conditions ensured by the two-way real-time data exchange among the physical counterpart and its digital twin. Complex systems can be effectively modelled by using multiple digital twins within a larger digital transformation in an Industry 4.0 strategy. To improve efficiency, accelerate innovation and make informed, data-driven decisions, organizations enabled through a digital twin which gives real-time and predictive insights [2]. Organizations used them to develop products design, supply chains efficiency, processes optimization and predictive maintenance.

1.1. Digital Twins and The Evolution of Human

Identity

In infant technology, human digital twins (HDTs) are a type of digital twin. Human digital twins (HDTs) are presently undefined, as are their identity, personhood and ethical considerations. To create HDTs, simulation data and machine learning are used to create virtual humans [3]. In other words, HDTs are duplicates of real-life types, interacting with the real world and its equivalents. Due to the fact that HDTs are digital entities, they can only exist in a digital world. As a result of cloud computing, artificial intelligence and high-speed video cameras, HDTs are continually adapting to the preferences of their users [4].

1.2. Legal Personhood Debates Surrounding Digital Twins

With the cyber world becoming less virtual and more real, the physical, biological and cyber worlds may soon merge. In addition to their identity and personality, HDTs face new challenges. Techno-enthusiasts and techno-apocalyptics may polarize in a debate over HDT's personhood. People are biologically and metaphysically linked, making personhood more than purely legal. A person is neither fundamental nor legal, although the two are complementary. Legal personhood implies that only persons can become legal persons, even though the term is ambiguous. Persons who are legally recognized as legal persons are bound by the law and can enjoy the corresponding rights and privileges. It is the same legal status for all biological persons, irrespective of their differences in appearance [5]. There are many different legal systems in the world; each one reflects the needs of its own society in terms of rights or qualities or magnitudes of rights [6]. Lunatics and sane people have different rights even though they are natural and legal persons. As shown in Table 1, HDTs do not possess a number of human-like properties, so they cannot be considered persons. A person's identity is essential to enjoying any right that is based on that identity. Arendt argues in 1967 that each individual has a proto-right, which is a pre-legal presupposition. García postulates that "the accreditation of personal identity is a necessity of the individual in his public and private relations, which is translated into the exigency of having available a reliable means for its perception, without ambivalences, in the real or physical world and in the virtual"[7].

Table 1 Functional and Legal Characteristics of Human Digital Twins

Feature	Status in Human Digital Twins
Interaction with Human Counterpart	Possible only when virtually connected
Intentionality	Absent
Consciousness	Absent
Freedom	Absent
Creativity	Absent
Rationality	Absent
Foresight	Absent
Autonomy	Absent
Liability Attribution	Not legally defined
Human-like Behaviour	Limited and simulated
Sentience	Absent
Moral Agency	Absent
Rights and Obligations	Currently Absent

Psychological factors [8,9,10], physical factors [11, 12] or narrative factors [13-16] can be used to assign a person a personal identity. According to state laws, individuals are identified by the objective features that comprise their identities. In addition to objective characteristics, an individual's identity includes subjective characteristics she constructs on an individual basis and communicates through her behavior [17]. It has been proposed by Goffman (1959) [18] that humans are affected by the circumstances in which they are communicating and constructing their identity differently. The psychoanalysts argue that identities aren't solid cores of personality. In order for identity construction to take place, identity identification must disintegrate, disorganize, and become fluid. An individual's identity is formed over time as a result of the continuity of his or her physical body. As a result of amnesia or brain damage, people's conception of themselves is based on their continuous physical bodies, which gives them access to their self-concept in a cognitively impaired state.

Although the human body suffers organ loss (e.g., limbs) or gains organs (e.g., synthetic structures, ranging from clothing to chip-controlled mind control), it continues to exist [19]. A similar immaterial existence exists for the mind and cognitive faculties. There has been much discussion about how the physical body and the immaterial mind relate [20], and HDT has complicated the issue by adding a virtual, online existence [21,22]. Through tools used in the "real world", namely social networking sites, business portals, and search engines, the HDT establishes the identity of his counterpart human in the virtual world. Achieving an identity for HDT requires understanding their present and future scenarios, as well as whether they adhere to utilitarian principles of 'the good' or a humanitarian or Kantian narrative that indicates that utility-maximizing is not necessarily a better choice in the long run. Legal identity will be accorded to HDT under the utilitarian model of 'the good'. The HDT may be thought of as a self-representation or split personality from a psychological standpoint. Identity singles out a person from the others. Thus, a HDT that has a sense of self [23] does not have a personality. Similarly, HDTs do not fit the scale of personal identity proposed by David Hume (1739) [24]. It is difficult to give a definite answer to what category HDTs belong into and what their characteristics and capabilities are as time progresses. For identifying HDTs, ISSNs, ISBNs, and DOIs can be assigned as for journals, books and papers. It is possible to hyperlink HDTs to original humans. Every human has an extended self (his self). It will be an issue where to fit this new entity in hierarchy. If the real natural person is accorded first order, then HDT should be accorded a second order legal identity as the latter exists merely due to former. As cells are building blocks of natural person, data of this natural person is building block of HDT. Risks: Identity Theft, Misuse, and Privacy Threats HDTs may be victimized by new forms of identity theft, abuse, and fraud if they are given a legal status. As an individual's visible features can be cloned, reiterated, or exercised, their identity can be isolated from the person holding the identity. The term "identity theft" describes the act of using another's identifying data, such as a name, driving license, passport and so on. In the digital world, identity theft can have a much more profound effect. As humans are quite unique and complex, it's impossible to create a HDT since they are too unique and complex to be replicated or "run" on any other physical stratum than our own. It's impossible to determine the point when the identity replication of humans becomes unethical or challenging, and why at that point.

2. Statement of The Problem

As digital twins become more prevalent, existing legal doctrines are challenged by the creation of virtual identities that can replicate, predict and even act independently of their real-life counterparts. Cyberlaw, data protection laws and identity-related doctrines are inadequate to address risks associated with misuse, autonomy violations and accountability gaps associated with virtual replicas.

3. Objective of The Study

This paper examines how human digital twins pose new questions about identity, privacy, consent and personhood. Identifying gaps in existing laws and understanding risks associated with digital replicas will be the primary objectives of the study. The study concludes by proposing a rights-based legal framework for regulating human digital twin use.

4. Research Methodology

An interdisciplinary, qualitative and doctrinal legal methodology is used in this study. An evaluation of how existing laws treat identity, autonomy, privacy and personhood in virtual environments was conducted by examining primary legal sources including statutes, case law, international conventions and regulatory frameworks. A collection of secondary sources was used for the interpretation of the conceptual foundations of digital identity, including scholarly articles, philosophical literature and papers on technology ethics. In order to identify cross-national gaps and trends, we compared jurisdictions in the EU, U.S., U.K., India and China. In addition to adopting a rights-based analytical framework, the research assesses whether artificial intelligence governance norms, data rights, or personality rights apply to human digital twins. A legal sound regulatory recommendation is proposed using an exploratory and analytical methodology.

5. Comparative Jurisdictional Analysis

Digital twins are governed differently in different jurisdictions, yet no region has enacted a comprehensive framework to govern the production of human digital twins. In the current legal framework, personal data is protected mostly by law, but there are major gaps in terms of digital identity, personhood, autonomy and ownership of algorithms generated models. Based on a comparison of current regulatory systems, it is evident that only fragments of the human digital twin ecosystem are addressed.

5.1. European Union (EU)

For safeguarding the sensitive biometrics and health information, some of the highest global standards maintained by the EU with the GDPR and the AI Act. Under "special category data", digital twins representing human physiology or behavior treated as well must fit with strict safeguards and explicit consent requirements. While GDPR and AI Act recognize digital twins themselves as autonomous constructs, they do not recognize them as a form of autonomous identity [25]. Despite the fact that ownership, personality rights and representation boundaries remain unresolved, these issues persist.

5.2. United States

There are numerous regulatory jurisdictions in the U.S., each with its own requirements. Data that is derived or predictive is excluded from HIPAA's regulation of medical digital twins [26]. There are a number of privacy laws on the books (CCPA, CPRA, Colorado Privacy Act) which provide protection of personal information, but they differ in their treatment of algorithmic profiling and biometric simulation. Digital replicas are not governed by federal law.

5.3. United Kingdom

Human digital twins remain underdeveloped in the UK, despite the country's policy leadership on infrastructure digital twins. While UK GDPR protects the rights of individuals over their personal information, it does not include definitions of identity for digital twins that evolve, self-update, or integrate predictive analytics [27]. In contrast to identity-based models of human behavior and physiology, digital health tools are regulated by the Medical Products Regulatory Authority (MHRA).

5.4. India

The Digital Personal Data Protection Act (2023) in India defines personal data rights and puts lawful processing obligations in place. However, Biometric simulations and predictive health models are not distinguished from one another as legal entities [28]. A person's identity, behavior, or algorithmic representations are not addressed in any of the provisions. Human digital twins aren't covered by sectoral laws (IT Act, DISHA framework).

5.5. China

A strict consent is required for the use of sensitive personal information under China's Personal Information Protection Law (PIPL). Individual autonomy, however, is overridden by government access [29]. Health care, public security and urban management are all using digital twin technologies, but the methods and procedures for creating and using individual digital representations are less transparent.

5.6. Proposed Regulatory Framework for Human Digital Twins

Intellectual Property ("IP") Ownership & Liability:

In digital twin ecosystems, intellectual property (IP) ownership is complex since digital twins may consist of multiple components, all of which are subject to different legal protections [30]. Copyright protection can be applied to software code and algorithms, while patent protection is available to innovative features that are used in modelling or prediction. Data models or algorithms that remain confidential can be protected by trade secrets. Several stakeholders are required to share data continuously in order for digital twins to function [31]. Due to this uncertainty, it is unclear who owns the resulting datasets and derivative models. It is common to find situations of joint ownership when clearly drafted agreements are absent, leading to uncertain rights, responsibilities and usage permissions. Identity and autonomy directly impacted through intellectual property rights at the situations where third parties are responsible for shaping the replica, uncertainty [32]. For clarifying ownership, access rights and restrictions on use and reproduction, contractual agreements need to be carefully drafted. The complexity of digital environments means conflicts over models and data

rights can strongly impact accountability and identity protection.

5.7. The Unique Case of Human Digital Twins and Medical Ethical Dilemma:

Virtual representations of individuals' physiological, behavioral and biometric data that are created as digital twins present ethical and legal concerns well beyond those associated with industrial digital twins [33]. Controlling and owning one's digital self is a key issue. Digital twins are increasingly being treated as inalienable rights, much like individuals have over their physical bodies. As a result of this position, companies are challenged with existing data-monetisation practices in which organizations claim ownership just for collecting or processing data. In healthcare, the continuous updating of a patient's digital twin complicates informed consent, as individuals may not fully understand the long-term implications of ongoing data integration. Consent given at the time of creation may not extend to subsequent algorithmic updates or incorporation of new data sources. Over-collecting and misusing health data are significant risks associated with these systems as they produce enormous amounts of sensitive health information. Further risks created through biopiracy and the unauthorized or commercial misuse of biological data. Algorithmic bias remains a major ethical concern, particularly when minority populations are underrepresented in training datasets. Such bias can result in inaccurate predictions, inequitable treatment recommendations and even discriminatory decisions by insurers that rely on simulated health outcomes.

5.8. Potential Legal Remedies:

Effective IP protection for digital twins demands an approach that combines legal strategies with technical safeguards. It can be achieved by filing for IP protection at important milestones in the digital twin's development lifecycle [34]. This includes when it becomes functional, when a new algorithm is deployed, or when a major UI update is rolled out, rather than waiting for it to be a "perfect fully functional" twin. Therefore, implementing a layered IP strategy is essential. Utilizing patents for innovations that demonstrate a real-world technical effect, copyrights for the specific expression of code, visual designs, and trade secrets for the proprietary hidden logic, data models and unique methodologies [35]. Creating a clear and comprehensive licensing and development agreements is essential. From the outset, usage rights, ownership, responsibilities and risk allocation details should be mentioned in these contracts. For avoiding future disputes, it is significant to use clear, concise terminology, to recognize mutual value, to negotiate flexible, to consider alternatives and proper documentation. Other than legal agreements, technical safeguards are also of key importance. Software licensing solutions, tamper-proof techniques like encryption, digital fingerprinting, etc. to prevent unauthorized access, reproduction and misuse of the digital twin's components, are some of the technical measures that can be used.

6. Discussion

Identity, autonomy, and legal personhood are fundamentally reshaped by the emergence of human digital twins. A digital twin can generate serious legal vulnerabilities, even as it improves simulation and behavioral insights. There are several risks that present themselves in cyberlaw and data protection regimes, including the misuse of biometric information, the abuse of virtual identities, and the replication of information without consent. A digital counterpart operating independently of human action struggles to adapt to the traditional Doctrine of Identity, which was built on physical, stable and singular selfhood. Liability and responsibility are further complicated by the growing use of digital twins. A legal reform is urgently needed, specifically regarding consent, data ownership and digital replica accountability. Digital replication must be regulated based on rights in order to protect human dignity and identity.

Conclusion

Simulation, prediction, and optimization capabilities of Digital Twins are being applied across industries. It is still not clear whether existing frameworks will be able to resolve legal concerns and ethical concerns raised by these advances. Traditionally, IP and liability rules do not apply to digital twins due to their inherent complexity and data-intensive nature. Protecting such innovations requires an elaborate and

adaptive IP strategy. Ownership is not monolithic; hence, it calls for distinct IP rights for codes, algorithms, data models, processing systems and UI, which requires a "think in layers" approach. In multi-party collaborations there is reliance on data sharing, which demands carefully drafted contracts to prevent disputes over data ownership and usage rights. Responsible development and widespread adoption of digital twins depend on the evolution of legal frameworks, implementation of carefully drafted contractual agreements, and a commitment to ethics by design and privacy by design. As these simulated innovations continue to redefine both- our physical as well as digital realties in the world of science and technology, collaborations among scientists, legal experts and especially policymakers will be essential to build a resilient and trustworthy ecosystem for digital twins and make it open to future integrations with block chain models and futuristic AI. A critical issue of autonomy, consent, and representation emerges as virtual identities develop into digital twins. Today's legal systems cannot cover highly realistic digital reproductions of cognition and behavior. Human dignity and identity exploitation can be prevented through the application of rights-based legal frameworks. In order to protect the digital self from becoming a site of vulnerability, law must keep up with technology.

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