AI CROSS-BORDER GOVERNANCE IN THE CONTEXT OF VIRTUAL-REALITY CONVERGENCE: DESIGN NEGOTIATION AND GLOBAL CONSENSUS MECHANISM IN THE ERA OF META-UNIVERSE

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ABSTRACT

In the context of rapid advancements in artificial intelligence (AI), the emergence of metaverse and other virtual–physical hybrid spaces has brought unprecedented challenges to AI governance, particularly in cross-border collaboration and cultural conflict. This paper adopts the perspective of ***design diplomacy*** *to construct a three-dimensional framework for AI governance, encompassing cultural interface design, hybrid governance structures, and negotiation mechanism building. It aims to explore the mediating role of design in international AI governance cooperation.*

Through a comparative study of governance logics in platforms such as Meta Horizon, The Sandbox, and Roblox, and a policy analysis of the OECD Principles on Artificial Intelligence alongside China's Administrative Measures for Generative AI Services, the study demonstrates the effectiveness of design approaches in enhancing governance transparency, improving user participation, and facilitating cross-cultural negotiation mechanisms. Based on focus group discussions and practical design tools, the research identifies five future-oriented consensus principles for AI governance: ***transparency, explainability, cultural sensitivity, multi-level participation, and system adaptability****.*

Ultimately, the paper argues that design is not merely a supplement to technology and policy, but a new language and method for building global consensus and cooperation in AI governance.

KEYWORDS

Artificial Intelligence Governance; Design Negotiation; Meta-Universe; Cross-Border Collaboration; Cultural Interfaces; Consensus Mechanisms

1. INTRODUCTION

1.1 Research background and problem formulation

Artificial Intelligence (AI) technologies are penetrating all aspects of human society at an unprecedented pace—from healthcare and financial systems to urban governance and education. These applications are continuously reshaping patterns of interaction between humans, and between humans and machines. However, the development of AI is not merely a technical leap; it also gives rise to a series of ethical, legal, and governance challenges. Issues such as algorithmic transparency and fairness have become recurrent concerns. Global debates now focus on how AI systems handle personal data and whether they contain discriminatory biases (Cath et al., 2018; Zuboff, 2019). Like an autonomous high-speed train operated by a black box, AI systems, without mechanisms of transparency and accountability, risk losing public trust.

At the same time, the emergence of hybrid virtual–physical spaces such as the Metaverse presents an unprecedented testing ground for AI technologies. Platforms like Decentraland and Meta Horizon integrate virtual reality, blockchain, and intelligent algorithms, creating environments that transcend traditional national borders and legal jurisdictions. Users may operate across countries, remain anonymous, and engage in systems where rules are defined by platforms rather than by states. In this "supra-sovereign space," the governance of AI becomes increasingly complex (Floridi, 2020; Cave & Dignum, 2019). The metaverse resembles a floating city—blurred in boundaries, shifting in identities, and lacking anchored governance—where traditional regulatory mechanisms often appear clumsy and inadequate.

Current models of AI governance predominantly focus on legislation, international agreements, and technology-driven risk management frameworks. However, this "technology–policy" axis often neglects the role of **design** as a socio-technical mediator. Design is not only a tool or medium but also a **negotiation mechanism**—one capable of building communicative bridges across cultures, institutions, and technological contexts (DiSalvo, 2012; Redström, 2006). In this sense, design acts like a multilingual translator, capable of crafting inclusive and consensus-driven dialogue platforms among fragmented stakeholders.

This study thus seeks to address the following core question: **How can "design diplomacy" be introduced as a complementary pathway in cross-border AI governance, to construct globally adaptable and culturally responsive mechanisms of consensus in the age of virtual–physical convergence?**

1.2 Research objectives

This study aims to address the increasingly prominent issue of cross-border coordination in global AI governance, particularly within hybrid virtual–physical domains such as the metaverse. While the international community has undertaken diverse efforts at both policy and technical levels, the pursuit of a "global consensus" remains highly challenging due to cultural differences, institutional heterogeneity, and the complexity of platform ecosystems. Therefore, this research introduces the concept of **Design Diplomacy** as a potential mediating mechanism in cross-border AI governance, and explores its practical integration into virtual environment governance structures.

Specifically, this study pursues the following objectives:

First, it seeks to examine how design diplomacy can serve as a harmonizing and coordinating force among multiple stakeholders—governments, platforms, developers, and users. By framing design as both a governance language and a tool, the research explores its potential role in consensus-building, conflict resolution, and collective action facilitation.

Second, the study focuses on emerging governance challenges within metaverse environments, such as identity virtualization, legal boundary ambiguity, rule automation through smart contracts, and the use of governance metaphors in user interfaces (Whittlestone et al., 2019; de Reuver et al., 2020).

Third, the research aims to construct a cross-border AI governance design framework suited to hybrid virtual–physical contexts. This framework will integrate not only technical standards but also participatory mechanisms and cultural adaptability, in order to enhance governance resilience.

Finally, grounded in theoretical inquiry and case-based analysis, this study proposes a set of actionable design tools and strategic instruments—including a **Consensus Mapping** model, **Governance Interface Prototypes**, and **Culturally Sensitive User Journey Maps**—to support negotiation and collaboration among diverse global actors.

2. Format Guide

2.1. State of the Artificial Intelligence's Cross-Border Governance

As artificial intelligence (AI) technologies continue to expand globally, the construction of a unified and coordinated cross-border governance system has become a shared concern of the international community. To regulate the development pathways of AI and address its potential risks, several international organizations and regional mechanisms have attempted to establish governance frameworks. Notably, the *OECD Principles on Artificial Intelligence* (OECD, 2019), published in 2019, represent the first AI governance guidelines endorsed by multiple national governments. These principles emphasize core values such as human rights, inclusive growth, sustainability, and transparent accountability. Subsequently, the European Union proposed the *Artificial Intelligence Act*, a draft regulatory framework that introduces a risk-based classification system for AI governance—currently considered the most operational legislative proposal in this field (European Commission, 2021). In addition, UNESCO adopted the *Recommendation on the Ethics of Artificial Intelligence* in 2021, aiming to establish a globally shared ethical foundation for AI development.

Despite the formalization of such governance mechanisms, their implementation in practice remains fraught with challenges. First, the fragmentation of governance actors complicates institutional coordination. International organizations, national governments, technology companies, and civil society actors often hold conflicting interests and lack a common governance discourse (Calzada, 2021). Second, discrepancies in standards have intensified systemic disjunctions: the EU emphasizes fundamental rights, the United States tends to adopt a market-oriented approach, while China prioritizes technological advancement and security control (Floridi, 2021). These divergent policy orientations further complicate issues such as cross-border data flows, algorithmic access, and liability determination, frequently resulting in global technological frictions.

Moreover, current AI governance is significantly shaped by a form of "technological discourse hegemony." Transnational tech giants hold control over algorithms, data, and platform infrastructure, thereby setting the de facto "rules" under which AI operates. In doing so, they have arguably surpassed the regulatory reach of traditional state sovereignty (Zuboff, 2019). This dynamic has exacerbated the marginalization of Global South countries in the emerging AI governance landscape, giving rise to new forms of "digital colonialism." In essence, the challenges facing cross-border AI governance are not only matters of institutional alignment but also deeper struggles over technological power, cultural sovereignty, and value recognition.

Therefore, addressing these structural problems requires more than intergovernmental agreements or top-down policy coordination. It calls for the introduction of new governance tools and methods that are culturally sensitive, systemically adaptable, and capable of mediating across actors—precisely where **design intervention** offers potential as a critical breakthrough in cross-border AI governance.

2.2. AI Challenges in Metaverse Environments

As artificial intelligence (AI) technologies become increasingly embedded in societal structures, the metaverse—a hybrid space integrating virtual reality (VR), augmented reality (AR), blockchain, and AI algorithms—is rapidly emerging as a new paradigm of the digital society. Compared to traditional internet environments, the metaverse features heightened immersion, real-time interaction, and transnational connectivity, thereby introducing a series of novel challenges to AI governance.

One of the foremost concerns is the **virtualization of identity**. In the metaverse, users can mask their real-world identities through customizable avatars and interact or transact using blockchain-based digital identities. This disrupts conventional regulatory logics based on "real-name authentication" and "national jurisdiction" (Nadini et al., 2021). When the legal attribution of actors becomes ambiguous, the assignment of responsibility and the establishment of accountability mechanisms for AI systems grow increasingly complex.

Second, the **blurring of governance boundaries** presents a significant challenge. Within the metaverse, clear national borders and uniform legal jurisdictions do not exist. Platforms often impose their own governance systems through terms of service, smart contracts, or decentralized autonomous organizations (DAOs), resulting in a "platform-as-law" paradigm (Suzor, 2019). For example, Decentraland implements decentralized governance through community voting, allowing users to shape AI codes of conduct and content rating standards. In contrast, Meta Horizon employs centralized governance, using proprietary AI systems for content moderation and safety interventions. These two models reflect the tension between **power decentralization** and **platform centralization**, while exposing the opacity and unaccountability of AI algorithms in managing privacy, bias filtering, and behavioral control.

Third, the **absence and lag of regulatory mechanisms** is a core problem in current governance. Metaverse platforms often operate in legal grey zones. In the absence of unified global AI governance standards, they may become "safe havens" for algorithmic misuse and technological experimentation. AI-driven non-player characters (NPCs), virtual assistants, and behavioral prediction models frequently collect and process user data without obtaining fully informed consent (van der Wurff et al., 2023). Moreover, platform algorithms usually operate as closed systems, making it difficult for external regulators to intervene in or audit their underlying logic.

Lastly, the metaverse facilitates a **structural devolution of governance power**, positioning users not only as content producers but also as co-governors. However, behind this seemingly participatory model lies a disparity in governance capacity. For instance, while DAOs allow users to vote on platform decisions, their reliance on complex smart contracts poses high technical barriers, often alienating non-expert users and exacerbating the governance divide between tech elites and general participants.

In summary, the governance of AI in the metaverse is not merely a matter of user experience or platform management. It constitutes a **multi-layered governance challenge** spanning legal, technical, cultural, and ethical domains. Within this context, exploring governance approaches that emphasize **cross-cultural sensitivity** and **participatory design** emerges as a critical pathway toward fostering more sustainable and inclusive AI governance in the metaverse era.

2.3. Intersection of design consultation and technology governance

In the face of the rapidly evolving challenges of artificial intelligence and its cross-border applications, it is no longer possible to respond to the complex needs of a diverse global society by relying solely on legal provisions or technical norms. In recent years, design has been re-examined as a methodological tool that can build "negotiation bridges" between institutions, cultures and technologies. The so-called "Design Diplomacy" refers to the intervention of design methods in the process of policy making and international dialogues, transforming complex issues into visible, sensible, and co-creative synergetic structures (Raami & Miettinen, 2017). In cross-cultural scenarios, design not only conveys information, but also creates space for understanding and dialog, thus breaking down communication barriers caused by institutional and contextual differences.

In the context of AI governance, design negotiation can be realized through a range of strategic tools, such as the use of service blueprints to demonstrate algorithmic governance processes or role-playing workshops to simulate transnational data regulation scenarios, thus facilitating the generation of collaborative policy prototypes. This idea fits well with the idea of Design Justice. Design Justice emphasizes that technological systems should not be dominated by technologists alone, but should be embedded in the experiences and value judgments of affected groups in order to achieve fair, inclusive, and resilient technological governance (Costanza-Chock, 2020). At the same time, "future design" or "speculative design" provides a forward-looking tool for AI policymaking by constructing "imagined futures of governance" and allowing the public to have a better understanding of the future of governance before it is realized (Costanza-Chock, 2020). By constructing "imagined futures of governance", it allows the public to participate in the critique and negotiation of policies before they are even put into place (Dunne & Raby, 2013).

In addition, at the level of specific platform construction, design does not only play the role of "beautifying the interface" in AI governance, but also directly embodies its governance logic. As some scholars have pointed out, "platform interface as policy" (interface as policy), what users can see, click, and participate in is essentially the externalized presentation of the platform's algorithm and policy will (Matias & Mou, 2018). Taking the meta-universe platform as an example, how users report AI anomalies, whether or not they can view their algorithmic recommendation records, and how the community voting process is designed are all expressions of the practice of "governance through interface". Therefore, user experience design and human-computer interaction design is not only a matter of technical realization, but also a key link embedded in governance ethics, power distribution and negotiation mechanism.

To sum up, design is not only a decoration on top of technology, but also an intermediary mechanism that can be used for system reconstruction, negotiation and dialog, and cultural docking. The systematic introduction of design methodology into the cross-border governance framework of AI can not only alleviate the tension between language, culture and technology, but also provide a new path of action for the creation of a more interpretable and participatory governance mechanism.

3. RESEARCH METHODOLOGY

3.1. Research framework and analytical model

In order to systematically explore the cross-border governance mechanism of AI in the context of meta-universe, this study constructs a Design Diplomacy Framework that integrates the design perspective and governance structure, with a view to providing an analytical tool that combines theoretical logic and practical operation. The framework consists of three core modules: cultural interface design, virtual-real governance structure, and negotiation mechanism construction, which correspond to the perception expression layer, structure operation layer, and collaborative action layer of the AI cross-border governance process, respectively.

First, the Cultural Interface Design module focuses on how users understand the behavioral logic of AI systems under different cultures, value systems and languages. The interface in the meta-universe is not only a platform for human-computer interaction, but also a carrier for embedding governance concepts and power structures. For example, in Decentraland's DAO voting mechanism, whether the voting interface is designed to be fair and transparent will directly affect whether users trust and participate in governance decisions. Therefore, the module emphasizes the promotion of affirmative and transparent governance participation through visualization, language localization, and multicultural symbol embedding.

Secondly, the Hybrid Governance Structure module responds to the problem of reconfiguration of rights and responsibilities arising from the parallel operation of AI systems between virtual platforms and real society. While traditional governance frameworks are based on physical states and legal boundaries, AI behaviors in the meta-universe may be regulated by multi-national laws, platform policies and algorithmic rules at the same time. By introducing the concept of “compound governance unit”, this study analyzes the power network and regulation chain that may be formed by the platform-state-community in AI governance, so as to reveal its multi-level interaction mode.

Finally, the Negotiation Mechanism Construction module focuses on how to promote consensus formation and responsibility synergy among different governance actors through design methods. The module emphasizes the use of tools such as stakeholder mapping, strategic prototyping, and governance theater to create a “synergy space” between institutional differences, cultural tensions, and technological heterogeneity, so as to develop a more effective and efficient governance system. "to create a more resilient AI governance structure.

Table 1 Framework Model Summary Form

Dimension	Content	Role
Cultural interface design	Multicultural interfaces and symbols embedded to enhance user participation and cognitive transparency	Improving the human-computer interaction experience and building culturally sensitive governance interfaces
Platform Operator	Primary implementer of rule-setting and algorithm deployment, with technical dominance	Enabling standardized implementation of platform-specific governance
Technology Developer	Ownership of the model and algorithmic architecture is a key group in “coding governance”.	Incorporating value preferences and technical judgment in governance
End users	Trust as a policy recipient and feedback provider affects the effectiveness of governance	Testing the actual operational effectiveness and adaptability of governance mechanisms

Based on the above framework, this paper further divides the core participants of AI governance into four dimensions: national governance institutions, platform operators, technology developers and end users. As the law and policy maker, the state's governance preferences are often influenced by political institutions and cultural traditions; platforms, as governance implementers, have specific rule setting and technology deployment capabilities; developers hold the right to choose algorithmic architectures and model weights, and are the "encoders" of AI governance; and users are the policy takers and feedbackers, whose participation and trust directly affect the effectiveness of governance. Users are the policy takers and feedbackers, whose participation and trust directly affect the effectiveness of governance. Through the cross-analysis of these four layers, this study aims to capture the dynamic interactions and negotiation tensions between multiple subjects in AI governance, and provide theoretical support for subsequent case studies and framework validation.

3.2 Case Study Approach

In order to deeply understand the diversified practical paths of AI governance in the era of meta-universe, and to verify the adaptability and analytical power of the Design Negotiation Model (DNM), this paper adopts a comparative case study, selecting representative meta-universe platforms and institutional documents as the objects of analysis, and launching a structural comparison of governance mechanisms and design elements. This paper adopts the method of comparative case study, selecting representative meta-universe platforms and institutional documents as the objects of analysis, and launching the structural comparison of governance mechanisms and design elements. The selection of cases follows three criteria: (1) the platform or policy should be representative and accessible in AI governance; (2) it can reflect the cross-cultural or cross-institutional control dimension; (3) it has a clear design expression or user participation mechanism.

First, this paper selects Meta Horizon, The Sandbox, and Roblox, three metaverse platforms with different styles, to explore their differences in AI content regulation, user governance mechanisms, and platform governance logic. meta Horizon adopts a highly platform-centered governance model, and its AI system focuses on content censorship, security response, and user guidance, with an interface design that emphasizes "default default". Its AI system focuses on content review, security response and user guidance, and its interface design emphasizes "default trust" and implicit user reliance. The Sandbox introduces a DAO governance model based on blockchain architecture, where users can vote on the development of the platform and adjustment of rules through SAND tokens, reflecting the typical trend of "sinking governance", while Roblox combines platform intervention and user autonomy, and builds a hierarchical governance channel at the design level, including parental control, developer forums and user guidance. Roblox, on the other hand, combines platform intervention with user autonomy and builds a hierarchical governance channel at the design level, including parental control, developer forums, and AI auto-recognition. There are significant differences in the expression of "platform interface as governance logic": Meta is dominated by implicit norms, The Sandbox is oriented to autonomous design, and Roblox embodies multi-layer negotiation and adaptive regulation.

Second, at the institutional level, this paper compares OECD's Principles for AI Recommendations with China's Measures for the Administration of Generative Artificial Intelligence Services (for Trial Implementation), which emphasize "human well-being", 'transparency' and "inclusiveness".

The OECD Principles emphasize “human well-being”, “transparency” and “inclusiveness” as the core, and are oriented to multinational coordination and cross-cultural consensus building; while China's Administrative Measures emphasize ‘controllability’, “data security” and “algorithmic filing”. China's management approach emphasizes the logic of national sovereignty-oriented technology governance, such as “algorithmic filing”. While the former favors value framework guidance, the latter focuses more on implementation paths and responsibility clarification. This policy contrast reveals the institutional tension between “soft ethical standards” and “hard regulatory provisions” in the cross-border governance of AI, and also reflects the different understandings of the balance between technological risks and values among governance subjects.

Analyzing the above platforms and institutional mechanisms from the design perspective, we can find that: Meta Horizon has a simple interface but opaque governance path, weak user participation, and easy to cause misunderstanding of the algorithmic black box; The Sandbox has embedded governance portals in the interface, and the design of the DAO process is clear but the threshold is high, and the composition of the participants has a “technical bias”; Roblox has a “soft ethical standards” and “hard regulatory provisions” institutional tension. "Roblox is embedded in the governance process through multiple channels, realizing relatively balanced interactive regulation. In terms of system design, the OECD principles are more inclined to be disseminated with the aid of illustrations and visualization manuals, with a high degree of “design friendliness”, while the Chinese approach favors a culture of rules and regulations, with clear operational instructions, but with a relatively closed participation in the design process.

3.3 Design Tools

After an in-depth discussion of the theoretical structure and platform practice of AI cross-border governance mechanisms, this paper further validates the feasibility and effectiveness of the Design Negotiation Model in real-life collaborative scenarios through the intervention of design tools and Action Research. This method emphasizes the collaboration and interaction between researchers and participants, and generates prototypes and strategies for AI governance consensus building through contextual simulation, role-playing, and iterative feedback.

First, the study uses the Stakeholder Mapping tool to systematically sort out the key stakeholders involved in AI governance, including national regulators, meta-universe platform operators, technology developers, user communities, international organizations, and ethical watchdogs. By constructing a three-dimensional coordinate map of “power-influence-participation”, this study can clearly present the collaborative relationships, role conflicts and cultural tensions of each governance subject. This map not only serves as a visualization tool for understanding the governance structure, but also provides an orientation basis for designing the negotiation path.

Second, the study uses Governance Journey Mapping (GDM) to simulate the specific process of AI governance in the meta-universe platform, reproducing a complete collaborative governance path from problem identification, issue proposal, platform response to user feedback. In the design process, special emphasis is placed on the cultural differences and institutional logic embodied in the key nodes of the governance process (e.g., transparent explanation of AI algorithms, design of user voting mechanism, dispute mediation mechanism). Through graphical means, users and policy makers can more intuitively perceive the technology governance process and achieve enhanced participation at the interface design level.

To supplement the qualitative insights, this paper organizes several rounds of focus group interviews, inviting international students, young researchers and developers from different countries and cultures to discuss in-depth issues such as how to perceive the cultural bias in AI governance, what kind of governance interfaces build trust, and what are the most important issues in AI governance. The discussion centered on the questions of “how to view cultural bias in AI governance” and “what kind of governance interface can build trust”. The group collaborated on tools such as consensus mapping and voting preference mapping to reveal the barriers to negotiation in AI governance issues due to differences in language structure, institutional experience and social trust mechanisms.

The study finds that most participants generally believe that the current mainstream AI governance toolkit is still biased towards Western cultural assumptions, technological rationality and elitist processes, and is not easily understood by non-native English speakers or audiences in developing countries. Thus, in the cross-cultural AI governance mechanism, design is not only the optimization of “expression”, but also the reconstruction of “governance language” and the creation of “negotiation space”. Therefore, the future evolution of AI governance model should systematically introduce collaboration and visualization-oriented design methods to promote the diversified and flexible development of collaborative governance structure.

4. Conclusions

This study finds that design, as a non-technical language, demonstrates a unique bridging function in cross-border governance of AI, which can establish a mediating mechanism for communication and collaboration between different countries and cultural backgrounds. The challenges of AI governance in the meta-universe environment have broken the traditional governance boundaries, and it is difficult to maintain the fairness and transparency of governance by relying solely on the technical path of “code is law”. In contrast, a governance structure that incorporates participatory design and negotiation mechanisms can better meet the real needs of “flexible, distributed, and dynamically adjustable” in the space of virtual-real integration. Through the analysis of several platforms and policy cases, the explanatory power and adaptability of the Design Consultation Model in dealing with complex cross-border governance structures are verified.

At the theoretical level, this paper establishes a new perspective of embedding “design negotiation” into the global governance of AI, which enriches the existing governance discourse based on law, policy and technology. The study further proposes the “five principles of consensus mechanism” applicable to cross-cultural governance of AI, i.e., transparency, interpretability, cultural sensitivity, cross-layer participation, and systemic adaptability, which provides a value framework and evaluation benchmark for future institutional design. Meanwhile, the study introduces service design, interface design, speculative design and other methods into the topic of technology governance, injecting the vigor of multidisciplinary integration into AI governance theory.

The comprehensive theoretical framing and empirical case analysis presented in this study provide a solid foundation for future interdisciplinary governance research. The comprehensive theoretical framing and empirical case analysis presented in this study provide a solid foundation for future interdisciplinary governance research.

At the practical level, the study suggests that design thinking and user participation mechanisms should be actively introduced into future AI international cooperation, and that “governance visualization interface templates” and “consensus map toolkits” with cultural adaptability and visualization features should be developed to enhance the accessibility and synergy of policies. The development of “governance visualization interface templates” and “consensus map toolkit” with cultural adaptability and visualization features to enhance policy accessibility and synergy. Despite the limitations of this study in terms of sample size and case selection, the design tools and negotiation framework proposed in this study are highly scalable. In the future, it can be further extended to emerging technology fields such as blockchain governance, AI ethical labeling system, and smart contracts, so as to continuously deepen the theoretical research and methodological innovation of the coupling path of “design-governance”.

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