

**Acceptance Logic and the Reconstruction of Subjectivity in AIGC:
Centering on Peter-Paul Verbeek' s Philosophy of Technology**

Haoran Li

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Acceptance Logic and the Reconstruction of Subjectivity

in AIGC:

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Philosophy of Technology

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Abstract

The rapid advance of artificial intelligence has reshaped individual behavior, cultural imaginaries, and social structures on a global scale. Within this transformation, AIGC (Artificial Intelligence Generated Content), through its interactive and generative capacities, has entered a wide range of sectors and everyday life. As a form of generative AI, AIGC features efficient content production and cross-modal creativity. These capacities expand its applicability while raising pressing challenges related to ethics and subjectivity. A central scholarly task is therefore to clarify the logic underlying the acceptance of AIGC and to assess its implications for ethical responsibility and the reconstruction of human subjectivity.

This study centers on the core research question of "the reconstruction of subjectivity in the process of technological acceptance." It integrates multiple perspectives from contemporary philosophers of technology to develop a comprehensive theoretical inquiry. The research takes Peter-Paul Verbeek's philosophy of technology as its principal theoretical foundation, focusing on three key concepts-technological mediation, moral materialization, and responsibility ethics. At the same time, it incorporates Don Ihde's postphenomenology, Shannon Vallor's technomoral virtue ethics, and Yuk Hui's theory of cosmotechnics, thereby constructing a pluralistic and dialogical theoretical framework. The dissertation addresses three central research questions:

Q1. How is AIGC accepted within society, and how do diverse cultural, ethical, and social factors collectively shape its logic of technology acceptance?

Q2. In the process of AIGC application and diffusion, how are subjectivity and ethical responsibility reconstructed through technological mediation, thereby transforming the relationship among humans, technology, and society?

Q3. How can ethical principles and social responsibility be embedded in the design and interaction processes of AIGC to construct an ethics-oriented design framework?

Drawing upon concrete technological applications, the study proposes a new theoretical framework for understanding the acceptance of AIGC technologies. Based on this framework, it provides a systematic analysis of Verbeek' s philosophy of technology, explicating his theoretical account of technological mediation. He argues that technology is not a neutral instrument but an active mediator that shapes human cognition and behavior. Verbeek particularly emphasizes that technology influences and structures human actions, and therefore anticipatory design should be adopted at the early stages of technological development to foster positive human-technology relations.

Drawing on cases such as the use of AI voice assistants by older adults, this study examines how design can regulate technological mediation to accommodate the specific needs of different social groups, minimize the exclusion of subjectivity, and ensure that technology embodies greater humanistic care. At the same time, drawing on

Don Ihde' s concept of "multistability," this study further argues that the mediating function of technology is characterized by openness and indeterminacy, meaning that design intentions can never fully predetermine the evolving configuration of the human-technology-society relationship.

This argument is further developed through Verbeek' s idea of the materialization of morality. He maintains that technology not only mediates human behavior but also internalizes moral and ethical values within its design, thereby shaping social conduct. For instance, virtual hospitals, AIGC-based recommendation systems, and automated decision-making illustrate how moral principles can be translated into technical functions that guide user behavior in normative ways. Special attention is given to AIGC medical systems, where ethical requirements can be transformed into concrete design features that effectively regulate decision-making and user interaction. Building on this, the research introduces Shannon Vallor' s notion of "technomoral virtues," emphasizing that ethical design should not be understood merely as a process of technical regulation, but rather as the cultivation of moral habits and virtues that emerge through the sustained interaction between users and society.

The discussion then turns to the ethics of responsibility, where Verbeek' s thought is applied to questions of responsibility allocation and moral obligation in AIGC design. Unlike traditional ethics, which often focus on retrospective blame, Verbeek highlights the prospective sharing of responsibility between designers and technological artifacts. This study explores how engineers and designers can assume responsibility proactively

during the design phase, proposing ways to integrate technological accountability with broader social and ethical responsibilities throughout the development and implementation of AIGC systems. Simultaneously, inspired by Yuk Hui' s theory of "cosmotechnics," the study reflects on the regional and cultural dimensions of AIGC' s ethical responsibility from a cross-cultural perspective, arguing that the reconstruction of technological responsibility is not only a normative issue, but also a redefinition of the relationship among humanity, technology, and nature.

From the perspective of interaction design, the research applies and extends Verbeek' s insights in practice. It integrates Technological Mediation, the Materialization of Morality, and the Ethics of Responsibility into an ethics-by-design framework. Designers are encouraged to pursue user experience alongside the internalization of ethical responsibility, thereby ensuring that AIGC achieves stronger social accountability and moral adaptability. Within this framework, design is conceived as an ethical practice, whose ultimate goal is to achieve virtue-oriented technological innovation through the co-shaping of humans and machines.

The innovation of this study lies in its multidisciplinary and multi-theoretical approach, which for the first time systematically integrates the ideas of Peter-Paul Verbeek, Don Ihde, Shannon Vallor, and Yuk Hui into the analysis of AIGC technological acceptance. It proposes an integrative framework that combines technological mediation, moral materialization, virtue ethics, and responsibility ethics, offering a new philosophical

pathway for future research on the ethical design and reconstruction of subjectivity in AIGC technologies.

However, this research also presents certain limitations. First, the scope of selected case studies remains relatively narrow, which may constrain the external validity and generalizability of the conclusions. Second, the exploration of the dynamic and multilayered nature of technological acceptance within complex socio-cultural contexts remains insufficiently developed, leaving the influence of macro-level factors, such as institutional structures, cultural traditions, and intergenerational dynamics, only partially addressed. Future research should therefore adopt a comparative cross-cultural and cross-structural perspective, further examining the multiple mediation mechanisms that shape technological acceptance, and exploring how to achieve a dynamic balance between technological innovation, ethical norms, and social responsibility in an increasingly globalized environment.

In summary, this study provides a novel philosophical lens for understanding the ethical challenges within AIGC's technological acceptance process, expanding the theoretical boundaries of philosophy of technology and techno-ethics in the field of emerging intelligent technologies. By synthesizing the theoretical resources of technological mediation, technomoral virtue ethics, and cosmotechnics, the research not only offers practical guidance for the ethical design and optimization of human-AI interaction, but also lays a theoretical foundation for promoting the synergistic development of artificial intelligence and social ethics in the context of globalization.

Keywords

AIGC; technology acceptance; Peter Paul Verbeek; Technological Mediation; materialization of morality; reconstruction of subjectivity; interaction design.

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Chapter 1 Introduction

1.1 Origins and the Formulation of Research Questions

1.1.1 Research Questions and Objectives

With the widespread application of AIGC, understanding and analyzing its process of social acceptance has become a central issue in the philosophy and ethics of technology. The "acceptance" of technology involves more than functional efficiency, it raises profound questions concerning ethics, culture, and human subjectivity. Therefore, this study addresses the following three major research questions:

Q1. How is AIGC accepted within society, and how do diverse cultural, ethical, and social factors collectively shape its logic of technology acceptance?

Q2. In the process of AIGC application and diffusion, how are subjectivity and ethical responsibility reconstructed through technological mediation, thereby transforming the relationship among humans, technology, and society?

Q3. How can ethical principles and social responsibility be embedded in the design and interaction processes of AIGC to construct an ethics-oriented design framework?

To answer these questions, this dissertation aims to explore the reconstruction of human subjectivity in the process of AIGC acceptance and to develop an integrative analytical framework grounded in the philosophy of technology. The study takes Peter-Paul Verbeek's philosophy of technology as its primary theoretical foundation, while also

integrating Don Ihde' s postphenomenology, Shannon Vallor' s technomoral virtue ethics, and Yuk Hui' s theory of cosmotechnics. Through this multi-perspectival approach, the research analyzes the social acceptance of AIGC, clarifies the complex relationships among technology, culture, and human values, and seeks to promote a constructive integration between technological development and ethical reflection.

1.1.2 The Development of AIGC Technology and Social Transformation

With the rapid development of artificial intelligence, global culture, individual behavior, and social structures are undergoing unprecedented upheaval. Historically, each major technological revolution has triggered a fundamental transformation of social structure. The steam engine propelled the Industrial Revolution, altered modes of production, and accelerated urbanization. The emergence of photography reshaped artistic creation in both method and content and deeply influenced the evolution of modern visual culture. These cases show that the rise of technology is often accompanied by a remaking of human subjectivity and socio-cultural forms. Today' s rise of AI signals another profound transformation of society. It is not a simple replacement of traditional tools; it is a deep reconfiguration of modes of thinking, social organization, and cultural values. From a philosophical perspective, such transformations reveal that technology not only changes social organization but also mediates human perception, moral reasoning, and the constitution of subjectivity itself.

Research on artificial intelligence can be traced to the 1950s, when computer scientists posed the core question of whether machines could simulate human thought. In 1956

John McCarthy and colleagues introduced the term "artificial intelligence" and convened the Dartmouth Conference, bringing together scholars from different fields to discuss how to endow machines with intelligence. Early AI research focused on symbolic reasoning and problem solving, aiming to make computers perform tasks such as theorem proving and game play. In the 1960s AI entered its first boom. Researchers developed rule-based expert systems, exemplified by ELIZA, which could simulate dialogue between a psychotherapist and a patient. Although its intelligence was limited, it laid groundwork for later progress. During this period the goal remained to realize machine simulation of human intelligence through programming. Initial applications of expert systems in medical diagnosis and engineering design suggested practical potential. Yet constraints on computing technology and capacity soon became binding. From the 1970s to the 1980s, expert systems failed to achieve broad deployment as expected, and AI research entered a winter. Even so, research did not stop. With advances in algorithms and computing power, new breakthroughs appeared. The revival of neural networks propelled machine learning and brought visible commercial value in settings such as spam filtering and personalized recommendation.

From the 1990s into the early twenty-first century, dramatic improvements in hardware performance and data storage enabled new progress. The rise of deep learning marked a turning point. Alongside discriminative approaches, generative models and the revival of deep neural networks drove rapid advances in speech recognition, image recognition, and natural language processing(Fig. 1). Unlike conditional probabilities in discriminative models, the joint probabilities modeled by generative approaches enable

the direct production of outputs. As a result, Artificial Intelligence Generated Content (AIGC) developed quickly and spread into domains such as image recognition, image generation, text generation, video generation, and audio processing. With deep learning applied to recognition and generation systems, AI has penetrated daily life: from autonomous driving and voice assistants to machine translation and AI art, application scenarios continue to expand(Fig. 2).

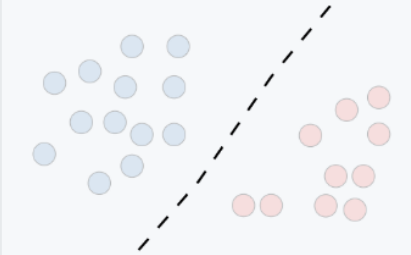
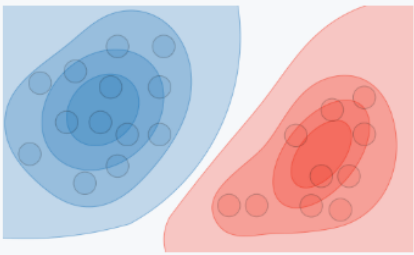
	Discriminative model	Generative model
Goal	Directly estimate $P(y x)$	Estimate $P(x y)$ to then deduce $P(y x)$
What's learned	Decision boundary	Probability distributions of the data
Illustration		
Examples	Regressions, SVMs	GDA, Naive Bayes

Fig.1. The logical distinction between generative artificial intelligence and discriminative artificial intelligence.Source:

<https://stanford.edu/%7Eshervine/teaching/cs-229/cheatsheet-supervised-le>

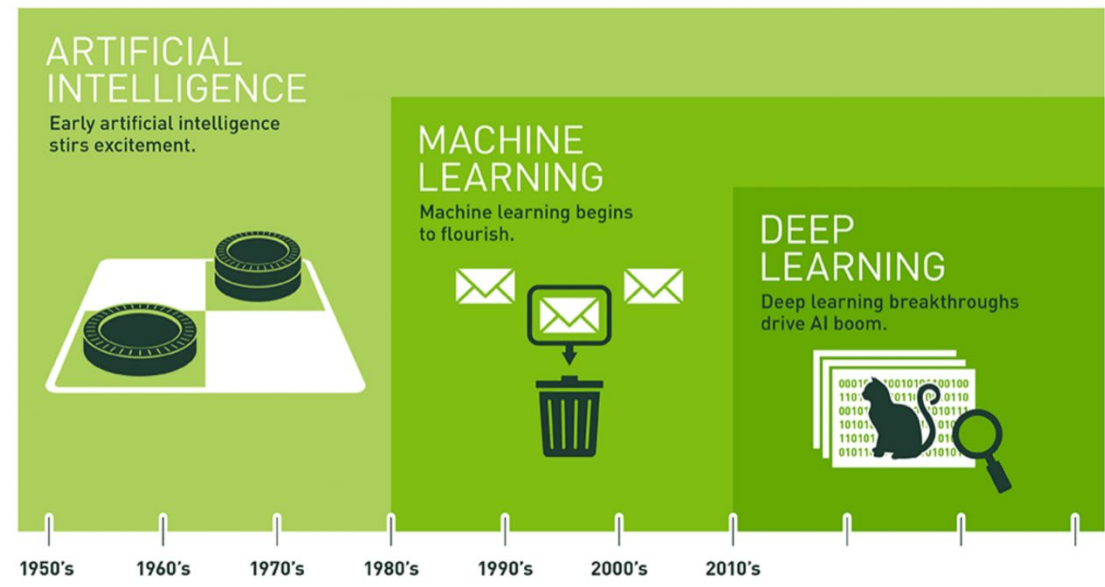


Fig.2. The historical development of artificial intelligence. Souce:

<https://blogs.nvidia.com/blog/2016/07/29/whats-difference-artificial-intelligence-machine-learning-deep-learning-ai/>

The spread of AIGC, especially via deep learning algorithms, is challenging traditional cognitive frameworks and raising unprecedented questions for human subjectivity. Traditionally, thinking and consciousness are complex cognitive processes unique to human beings. The concept of artificial general intelligence (AGI) seeks to endow machines with human-like consciousness and autonomous decision making. Current AIGC, including large language models, remains a form of narrow AI. Its outputs depend on large-scale data training and probabilistic computation rather than genuine self-awareness. This situation foregrounds a key issue: AIGC has not realized the essence of thinking, yet it is already challenging the boundary of thinking and subjectivity in practice. This paradox exemplifies technological mediation: even

without genuine consciousness, AIGC reconfigures human understanding of thinking itself, prompting a redefinition of what counts as cognitive and moral agency.

John Searle's "Chinese Room" thought experiment holds that even if an AI system could carry on impeccable conversation in Chinese, it would be manipulating symbols without genuine understanding¹. This view suggests that AI "thinking" is a computational process based on preset rules rather than the deep self-awareness and understanding that humans possess. The philosophical question is therefore not simply whether AI can think but how AI is redefining the boundary of thinking and the nature of consciousness.

The diffusion of AIGC is reshaping social structures and cultural conceptions. Its impact on labor markets and creative practices is especially evident. Automation and robotics are gradually replacing traditional labor, particularly low-skill and highly repetitive work, which invites reflection on employment models and welfare systems(Fig. 3). AIGC is not confined to production. It has entered domains of decision making, artistic creation, and even affective life. The rise of AI art challenges the traditional notion of authorship. Machine-generated works in visual art and music increasingly approximate those of human artists, provoking philosophical debate over creative subjectivity and artistic value(Fig. 4). If beauty can be generated by algorithm, does the identity of the artist still matter, and is technological mediation displacing human creativity?

¹ Searle, J. (1999). The chinese room.



Fig. 3. Traditional automobile factory versus unmanned super factory/"dark

factory" (since no workers are needed, the factory can operate even with the lights

turned off). Source: Google Images.

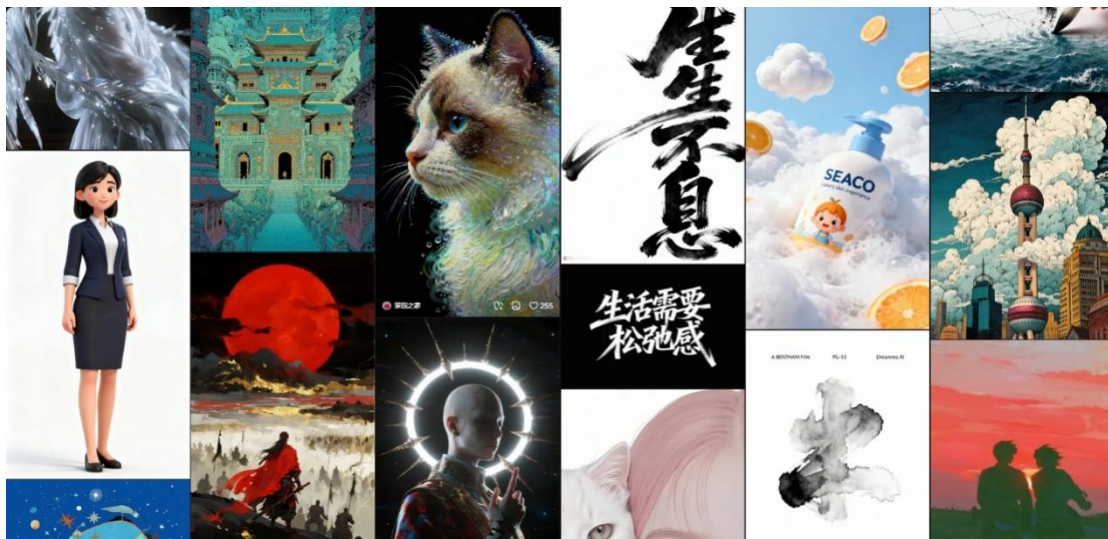


Fig. 4. AIGC-generated artworks and design pieces in various styles. Source:

Dreamina official website.

The spread of AI also poses new challenges for human subjectivity and values. Michel Foucault noted that technology is intertwined with mechanisms of social power². As AI

² Foucault, M. (1975). Discipline and punish. A. Sheridan, Tr., Paris, FR, Gallimard.

spreads, human behavior and social structures become progressively automated. From decision-support systems to personalized recommendation, technology plays an ever larger role in daily life. AI is no longer an external tool; it permeates individual decision processes and blurs human primacy in judgment, creation, and choice. In health care, diagnostic systems are shifting clinical judgment toward algorithmic assessment rather than relying solely on physicians' experience. On social media, recommendation systems filter and push content according to user interests and behavior, reshaping information access and social interaction. These developments challenge free will and value frameworks. Whether technology is gradually displacing the distinctive position of the human in society, culture, and thought has become a central problem in philosophy and ethics.

In art and design, the development of AIGC has shaken long-standing assumptions about professions once thought resistant to automation because they rely on imagination and creativity. The emergence of image-generation models such as Stable Diffusion has produced a strong shock to painting and design. With simple prompts and reference images, AI can generate refined artworks or high-resolution renderings. The threshold for creation has fallen sharply. Many professional illustrators and digital artists have voiced existential concerns. At the Colorado State Fair, a digital-art prize was awarded to "Théâtre D'opéra Spatial," a work generated with the AIGC tool Midjourney by game designer Jason Allen, which reignited debate about the subject of artistic creation(Fig. 5).



Fig. 5. Award-winning artwork by Jason Allen, created using the AIGC tool

Midjourney.

The shock of AIGC to art invites comparison with the impact of photography on traditional painting centuries ago. In early modern Europe, painting largely served recording and representation for aristocratic and religious needs, which fostered realism. The camera broke this monopoly. Since photography could capture reality directly, many artists who depended on realist representation lost their previous social position. Yet the shock did not end painting. It liberated painting from mere representation and stimulated Impressionism, Post-Impressionism, Expressionism, Cubism, and Surrealism. Photography also opened new media and modes such as the photographic print and collage. By analogy, the current shock of AIGC to painting and design may signal a new paradigm shift. Technology may replace parts of traditional practice and at the same time foster new forms of subjectivity and creation. This transformation

suggests that subjectivity itself is mediated and co-evolving with technological affordances, calling for a rethinking of the moral and ontological status of the human.

AIGC is therefore more than an upgrade to productive tools. It is becoming a key force that shapes human behavior, cognition, and social structure. It is transforming work, social interaction, and everyday life, and it even presses us to reconsider how we define human subjectivity and social roles. As technology permeates every level of society, AIGC is prompting renewed reflection on the boundary between human life and technology. A systematic analysis of these changes can provide a clearer framework for understanding the complex relations between technology and humanity and between technology and ethics in contemporary society. In this sense, the development of AIGC is not only a technological evolution but also a moral event that redefines the mediation between humans, machines, and values.

1.1.3 Multidimensional Exploration of Technology Acceptance

Technology acceptance is a complex, multidimensional issue that extends well beyond user experience and technical functionality. It concerns not only how functions and performance meet user needs but also how ethics, culture, social behavior, and intergroup differences shape uptake. From a philosophical and ethical standpoint, acceptance also entails an inquiry into how technology mediates human values, reshapes subjectivity, and reconfigures the moral relation between humans and machines. In the context of rapidly advancing AI, research on acceptance has shifted toward broader social questions, including how technologies affect different social

groups, how they shape social identities, and how they embody and transmit cultural values. Technology does not affect all groups in the same way. It exhibits marked subject-related differences that emerge from cultural background, technological literacy, social identity, and ethical outlook, and these differences decisively shape both the process and the outcome of acceptance.

First, acceptance is deeply influenced by ethical and cultural factors. Every new technology is designed and applied within specific cultural and social contexts. Different cultures and social groups develop distinct understandings, needs, and expectations of technology. For example, many Western societies prioritize individual freedom, privacy protection, and autonomous decision making; technologies in these contexts often stress safeguarding privacy and choice. In many East Asian contexts, by contrast, collectivism and social responsibility may receive greater emphasis, and technology is often framed as a tool for strengthening communal functions and enhancing collective well-being. Such cultural differences influence design priorities and also shape attitudes and behaviors toward acceptance. They appear not only in what functions are demanded but also in ethical conceptions: Western societies may focus on how technology augments individual autonomy and choice, whereas Eastern societies may attend more to how technology promotes social harmony and collective interests. Technology thus operates not only as a tool but as a carrier of social and cultural values. This difference precisely confirms Yuk Hui' s perspective of cosmotechnics, which emphasizes that the development of technology is always embedded within each culture' s own cosmology and moral order, and that the logic by

which different cultures receive and engage with technology reflects their distinct value universes³.

A common example is surveillance and facial recognition. In many Western settings, public-space deployment is frequently questioned and framed as a violation of privacy and of bodily data. In regions where collectivist orientations are stronger, these technologies may gain broader acceptance because they can reduce enforcement costs and enhance public safety; many people are willing to trade part of their personal control for a safer environment that benefits the collective. Design responses differ accordingly. Western approaches to public safety may rely more on environmental strategies, reducing low hedges and visual barriers in parks, using larger storefront windows and better lighting to improve sight lines, so as to leverage informal social oversight while protecting privacy. These strategies are less effective in areas with few pedestrians or at night. Features such as automated driving aids and "sentry mode," which rely on cameras and computer vision for continuous scanning, are sometimes constrained by regulation in certain Western countries, reducing convenience for residents. In some East Asian countries, extensive use of facial recognition and CCTV has raised the perceived risk of committing crimes and improved the efficiency and cost-effectiveness of governance, contributing to a strong sense of public safety and enabling more diverse possibilities in public-space design. Cashless face-based payment, automated driving, and sentry-mode features have also become more common. At the same time, privacy breaches, the misuse of personal data, and related

³ Hui, Y. (2020). *Cosmotronics*. Angelaki, 25(4), 1-2.

forms of cybercrime pose new challenges(Fig. 6.1-6.2). This indicates that the acceptance of technology is not merely a matter of experiential adaptation but fundamentally an ethical practice at the level of values. Within different civilizational contexts, it manifests diverse forms of technomoral virtues, becoming an opportunity for cultural self-reflection and moral renewal⁴.

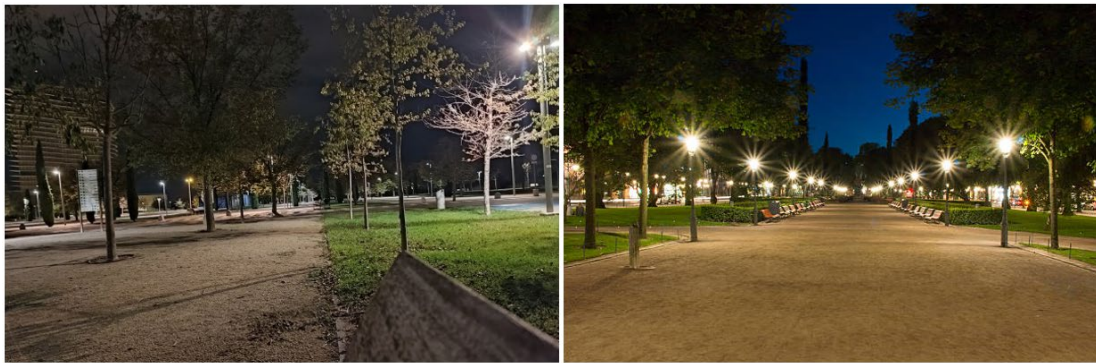


Fig. 6.1 Western urban parks are designed with good visibility and lighting even at night. Source: Google.



Fig. 6.2 Eastern urban parks focus more on landscaping and scenic layers. Source: Google.

⁴ Vallor, S. (2016). Technology and the virtues: A philosophical guide to a future worth wanting. Oxford University Press.

Ethical outlooks fundamentally shape the mediation between human agency and technological action, determining how moral responsibility is distributed and how technologies are integrated into social practices. In sensitive domains such as health care, education, and finance, acceptance cannot be reduced to efficiency and performance; ethical challenges must be considered. In medicine, AI diagnostic systems can improve accuracy, yet if models fail to account for individual differences or to protect privacy, they may trigger ethical controversy. In education, personalization may alter teacher-student relations; a key design question is how to tailor content without allowing technology to dominate behavior or erode autonomy. Ethical considerations thus become both a determinant of acceptance and a precondition for embedding technology appropriately within social structures.

Second, differences in social behavior and identity formation play a decisive role. Diffusion is rarely uniform across groups. In early phases especially, many face high barriers due to gaps in technological literacy and access to resources. Older adults, for example, often have limited experience interacting with digital systems; when using AI voice assistants or smart-home devices, they may encounter cumbersome operations and develop resistance, lowering acceptance. Acceptance is not only a matter of operability; it also concerns how technology mediates self-understanding and identity formation. For some groups, technology is a means of improving quality of life. For others, it unsettles social roles and identities-particularly where automation displaces labor and forces role reconfiguration. Technology can become part of "self-identity," shaping attitudes toward adoption.

In contemporary society, the spread of AIGC and automation is eliminating traditional positions. Many low-skill jobs are being replaced by robots and automated systems. For low-income groups or those with limited technological literacy, barriers to access arise from both resource and knowledge constraints and from social identity and economic status. Skepticism is common: technological change may not be experienced as beneficial and may intensify inequality. For these groups, acceptance reflects not only judgments about function but also assessments of how technology affects social standing and self-understanding. Thus, technology acceptance must be interpreted as a process of ethical mediation within power structures, where the design and diffusion of AIGC redistribute responsibility and agency among humans, institutions, and algorithms.

As AI penetrates more domains, acceptance is shaped by social structure and power relations. Technology is never neutral; it is entangled with distributions of power. Acceptance varies with social position, economic resources, and political influence. Lower-income groups may lack devices or connectivity and thus miss out on benefits. In some regions, the digital divide persists or widens, and the diffusion of AI can exacerbate inequality, especially when data privacy protections and algorithmic transparency are weak, reinforcing asymmetries of power and placing certain groups at a disadvantage. This phenomenon reveals that technology is not a neutral force but rather a "moral actor" within a socio-technical system. The diffusion of AIGC, therefore, should be understood as a process of co-construction among technology, institutions, and ethics, rather than as a one-directional spread of tools.

Technology acceptance is therefore not merely a problem of technical fit. It is a social question that involves equitable diffusion on a global scale and the design of inclusive systems that avoid exacerbating inequality across cultures and classes. Designers and policymakers should foreground inclusion and diversity, ensuring that technologies can meet the needs of different groups while supporting social progress as a whole. Ultimately, the question of acceptance is inseparable from the question of mediation: only by embedding ethical reflection into technological design can societies achieve genuinely inclusive and responsible AIGC development.

1.2 Research Status and Critical Review

1.2.1 Research Status

1.2.1.1 Research Status of Verbeek's Philosophy of Technology

With the rise of emerging and disruptive technologies, Peter Paul Verbeek's philosophy of technology has gained sustained attention across philosophy of technology, ethics, and the social sciences. In the context of rapid advances in AI, the Internet of Things, and smart cities, Verbeek's theory of technological mediation and his account of the materialization of morality offer theoretical guidance and a basis for critical reflection on relations between humans and technology and on the ethical problems that accompany technological development. This orientation has generated notable responses worldwide, especially in Western debates in the philosophy of technology, where Verbeek's works are frequently cited and extended. Citation counts and

frequency have continued to rise, and his writings have become important references in technology ethics.

Verbeek's theory of technological mediation emphasizes that technology is not merely an instrument. Through design and use, technologies mediate and shape society, culture, and individual conduct⁵. Rejecting traditional instrumentalism, This study employs Verbeek's notion of technology functions as a medium in interactions between humans and the world, altering perception, action, and ethical judgment. This challenges tool oriented views by showing that the role of technology exceeds surface functionality; it exerts deeper influence on social structures and cultural identities. Smartphones, social media, and AI systems, for example, have transformed interpersonal interaction while subtly shaping values, moral choices, and social roles.

At the same time, Verbeek's notion of the materialization of morality extends the ethical dimension of technological functions⁶. Technical artifacts are not bare tools for achieving pre set ends; by virtue of their design and internal structure, they can embed moral norms and tacitly guide user behavior. The core claim is that design features such as feedback mechanisms, constraints, and defaults can cultivate ethical conduct without relying exclusively on external moral oversight. Health management functions in smart devices, for instance, can foster healthier behavior through built in prompts and routines rather than external compulsion. These ideas have drawn broad interest and prompted

⁵ Verbeek, P. P. (2015). Toward a theory of technological mediation. *Technoscience and postphenomenology: The Manhattan papers*, 189, 2015.

⁶ Verbeek, P. P. (2006). Materializing morality: Design ethics and technological mediation. *Science, Technology, & Human Values*, 31(3), 361-380.

new questions about the relation between artifacts and moral norms. They have also inspired reflection on how technologies shape societies and individual behavior in domains such as smart health care, smart cities, and AI. How to embed moral considerations in design and how to advance social welfare through mediation have become focal points of current research.

In terms of theoretical elaboration, scholars abroad have further developed Verbeek's insights. Shinya Oie, for example, expands Verbeek's idea of relational freedom toward a notion of autonomy, linking Verbeek's account of agency to personal freedom⁷. This helps clarify how mediation affects choice and how technological interventions recalibrate autonomy, advancing postphenomenology within ethics and political theory. D. Mykhailov, drawing on Verbeek's mediation theory together with Karl Jaspers, proposes a new relation between humans and technology called "transcending mediation," arguing that technology can shape relations not only between humans and the world but also with transcendent realities, thereby enriching mediation theory⁸. Such developments extend Verbeek's work beyond traditional frames in the philosophy of technology into interdisciplinary conversations with ethics, politics, and sociology.

Further, M. Bantwal Rao and J. Jongerden, among others, reinterpret technological mediation through the lens of autonomist Marxism and highlight power relations within

⁷ Oie, S. (2023). From relational freedom to autonomy: An expansion of Verbeek's postphenomenology. *Human Studies*, 46(3), 423-442.

⁸ Mykhailov, D. (2023). Mediation and transcendence: Balancing postphenomenological theory of technological mediation with Karl Jaspers's metaphysics of ciphers. *Human Studies*, 46(3), 405-422.

mediation⁹. They argue that artifacts are embedded within social power structures and that design and use reflect specific social and political configurations. From this perspective, scholars examine how technology shapes social behavior and subtly strengthens or weakens certain power relations, especially those tied to class, economic position, and political authority. This extension illuminates the complex nexus of mediation, power, and society, opening new vistas for understanding the role of technology in social life.

Verbeek's ideas have also influenced practical fields. Many researchers seek to apply technological mediation and the materialization of morality to issues in smart cities, digital health, and environmental protection. For instance, Sage Cammers Goodwin investigates how Verbeek's framework can bridge gaps between citizens and smart urban infrastructures, exploring ways to meet social needs while aligning design with ethical norms¹⁰. Carolin Prigge and Dorthe Brogård Kristensen link Verbeek's analysis of artifacts and moral action to self tracking practices and examine how technologies dynamically shape perception and behavior¹¹.

Critiques remain. Some question whether artifacts genuinely possess moral agency.

Don Ihde's account of multistability holds that design intentions cannot fully anticipate

9 Bantwal Rao, M., Jongerden, J., Lemmens, P., & Ruivenkamp, G. (2015). Technological mediation and power: Postphenomenology, critical theory, and autonomist marxism. *Philosophy & Technology*, 28(3), 449-474.

10 Cammers-Goodwin, S. I. (2023). Bridging the gaps between humans and their infrastructure: What are the challenges for citizen engagement introduced by increasing smart urban infrastructure and how might those challenges be mitigated?.

11 Loscri, V., Chiaraviglio, L., & Vegni, A. M. (2024). *The Road towards 6G: Opportunities, Challenges, and Applications*. Switzerland: Springer Nature.

relations that emerge between artifacts and users, which implies that moral effects in use cannot be precisely predicted nor grounded solely in designers' ethical presuppositions. Evan Selinger and others argue that operationalizing the materialization of morality raises difficulties, especially in balancing mediation with free will; ethical guidance by design risks overstepping and unduly shaping moral judgment and choice¹². Martin Peterson further contends that Verbeek's position conflicts with virtue ethical views, maintaining that artifacts lack moral subjectivity and that moral quality does not derive from artifact intentionality¹³. These objections sharpen debate around Verbeek's framework and suggest directions for refining it. Building on this foundation, Shannon Vallor's concept of "technomoral virtue" offers a complementary perspective to Verbeek's thought¹⁴. Vallor argues that rather than debating whether technological artifacts possess moral agency, the focus should be on how humans cultivate new "technomoral virtues" in their co-evolution with technology, using virtue practices to mediate human-technology relations and achieve ethical growth. This perspective, to some extent, addresses the limitations of Verbeek's framework by shifting the ethical inquiry from the intentionality of technology to the cultivation of human virtue and practical wisdom.

12 Selinger, E., Ihde, D., Van De Poel, I., Peterson, M., & Verbeek, P. P. (2012). Erratum to: Book Symposium on Peter Paul Verbeek's *Moralizing Technology: Understanding and Designing the Morality of Things*. Chicago: University of Chicago Press, 2011. *Philosophy & Technology*, 25(4), 605-631.

13 Selinger, E. (2014). Three objections to Verbeek. *Philosophy & Technology*, 27(2), 301-309.

14 Vallor, S. (2016). *Technology and the virtues: A philosophical guide to a future worth wanting*. Oxford University Press.

In sum, Verbeek's philosophy of technology has exerted wide influence in technology ethics, social studies of technology, and postphenomenology. Although critical perspectives persist, his work continues to push ethical inquiry to deeper levels and to offer conceptual resources for addressing moral challenges posed by contemporary technologies. As technologies evolve, especially in AI, digital health, and smart urban infrastructures, Verbeek's insights are likely to play an ongoing role in design practice and ethical governance.

1.2.1.2 Current Research on Technology Acceptance

Research on technology acceptance has progressed markedly in recent years, especially in information systems and human computer interaction. As technologies advance and new systems appear, scholars have proposed multiple acceptance models to explain why individuals and groups adopt or reject innovations. These models draw on psychology and behavioral theory and focus on attitudes, perceptions, experiences, and intentions. The Technology Acceptance Model proposed by Davis in 1989 examines how perceived ease of use and perceived usefulness shape attitudes and behaviors toward technology adoption¹⁵. TAM quickly became foundational and clarified how users evaluate ease and benefit. Its limits have also become visible. In complex environments TAM gives insufficient attention to culture, ethics, and group differences that strongly affect acceptance.

15 Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). Technology acceptance model. *J Manag Sci*, 35(8), 982-1003.

The Unified Theory of Acceptance and Use of Technology was introduced as a synthesis of core elements from prior theories, including perceived usefulness, perceived ease of use, social influence, and facilitating conditions¹⁶. UTAUT highlights social context and individual factors and assigns roles to variables such as gender, age, and experience while stressing environmental enablers. Although more comprehensive than TAM, UTAUT remains rooted in behavioral science and gives limited treatment to ethics, social responsibility, and cultural identity.

These models provide valuable frameworks and data, yet their limits appear as modern technologies permeate daily life. Under widespread adoption of AI, the Internet of Things, and big data, traditional models emphasize usability and functionality while overlooking deep effects on persons, society, and culture. AI now operates in decision making, creativity, and interaction. The question extends beyond whether users will adopt. It also concerns equitable acceptance across cultures and the ethical issues that arise during use. Conventional models do not fully account for behavior when ethics, cultural difference, and social identity are salient.

As AI and intelligent systems are embedded more deeply in society, research on acceptance increasingly emphasizes ethical features of design. Scholars examine how to internalize moral norms in artifacts and how mediation can guide social behavior. Verbeek's philosophy of technology, especially technological mediation and the materialization of morality, opens a new perspective. Technology is not neutral¹⁷.

16 Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS quarterly*, 425-478.

17 Verbeek, P. P. (2024). *Moralizing technology: Understanding and designing the morality of things*. University

Through design and use, it modulates social conduct and affects moral choice. Design can guide people toward ethically desirable behavior without external coercion. Smart home devices can default to energy saving modes that reduce consumption. Algorithmic recommendation can influence choices and values. The outstanding tasks are to embed moral standards in design and to avoid bias and unfairness in practice.

These questions are acute in domains such as smart homes and automated driving. Researchers ask how to foster ethical conduct by design and how to ensure transparency and fairness in AI decision making through the materialization of morality. Here the limits of traditional models are most visible since they focus on usability and benefit while neglecting structural and ethical effects. Verbeek's framework helps relate design to social behavior and provides guidance for future development and deployment.

Although many acceptance models show predictive power, in depth analysis from philosophical and ethical perspectives remains scarce. With the spread of AI the field must address ethical challenges and fairness across social and cultural settings. We need to study how these technologies shape society, culture, ethics, and behavior, and how design can promote ethical conduct and equitable access in a global and plural world. These have become central problems for contemporary research on technology acceptance.

Accordingly, future work should integrate perspectives from philosophy, ethics, and sociology. Researchers should assess not only technical performance but also cultural

and social consequences and explore how mediation can advance welfare and justice. The focus has widened from individual adoption and rejection to ethical design, cultural adaptation, and fair diffusion in a global context.

1.2.2 Review and Assessment of the Research

Verbeek's philosophy of technology has become central to contemporary technology ethics, especially his accounts of technological mediation and the materialization of morality. These theories offer a framework for understanding how technology shapes social behavior, cultural identity, and individual cognition. Despite broad international influence, including strong uptake in Western debates, limits remain in practical applicability and depth.

Mediation theory holds that technology is not a mere tool. Through design and use it modulates perception, action, and social structure¹⁸. This idea has gained wide acceptance and has stimulated inquiry into the ways technologies influence relations and behavior. Disputes persist regarding scope and effect. It is difficult to specify the boundaries of mediation and to determine whether technologies possess any autonomous regulating capacity. Critics worry about overreach that could unduly constrain individual freedom, especially with intelligent systems. Empirical evidence is still limited on whether mediation can consistently align with moral and social norms.

18 Smits, M., Bredie, B., Van Goor, H., & Verbeek, P. P. (2019, November). Values that matter: Mediation theory and design for values. In Academy for Design Innovation Management Conference 2019: Research perspectives in the era of Transformations (pp. 396-407). Academy for Design Innovation Management.

The materialization of morality supplies an innovative ethical frame by claiming that artifacts can embed norms and subtly guide behavior. Questions remain about operationalization. Do artifacts possess any moral agency, and can design genuinely promote moral action? The issue is pressing for intelligent and automated systems. Can materialization secure fairness and justice and prevent moral bias introduced by design and data? These are still open problems.

Applications are growing but often remain at the level of initial frameworks. Verbeek's ideas have been introduced into areas such as smart cities and intelligent medicine, yet systematic empirical studies are few. How to design AI systems that meet ethical standards while maintaining performance, transparency, and fairness remains insufficiently explored. Much current work remains abstract and lacks tight coupling to practice.

At the same time, acceptance research has advanced through models such as TAM and UTAUT. TAM emphasizes perceived ease and usefulness. UTAUT incorporates social influence and facilitating conditions and broadens the set of variables. Despite strong predictive value, these models focus on attitudes and intentions and do not adequately treat cultural, ethical, and social layers. As AI reaches deeper into social life, decisions reflect moral outlooks, social identity, and cultural background in addition to functionality.

With the spread of AI, research has begun to emphasize ethical design. Scholars ask how to embed norms by design and how mediation can regularize conduct. Verbeek's

account adds an ethical dimension to acceptance studies by shifting attention to design level moral standards and to the promotion of social welfare and justice. Even so, many studies still center on functionality and usability. We need inquiry into fairness and transparency across diverse cultural settings and into the balance between mediation and individual freedom. Verbeek's framework supports this future direction and points to open space for research on the design of ethically aligned systems and on the guidance of moral behavior through artifacts.

In conclusion, while Verbeek's thought has stimulated wide theoretical discussion and some initial applications, deeper empirical analysis is needed. As AI spreads, future research on acceptance should integrate multiple disciplines and address how design can solve ethical problems and enable fair adoption under conditions of globalization and cultural diversity.

1.3 Research Content and Methods

1.3.1 Research Content

The primary aim of this study is to examine the social acceptance of AIGC technologies, with particular attention to the interrelationship among subjectivity, ethical responsibility, and technological mediation in the process of technological acceptance. With the rapid development of AI technologies, technology is no longer merely a tool serving human purposes; it has increasingly become a shaper of social behavior,

influencing human cognition, conduct, and moral understanding. This research explores the multidimensional dynamics of AIGC acceptance, analyzing how such technologies affect social structures, individual behavior, and ethical values, especially in relation to how technological design influences moral action.

At the theoretical level, the study is grounded in Peter-Paul Verbeek's philosophy of technology, while integrating Don Ihde's postphenomenological perspective, Shannon Vallor's technomoral virtue ethics, and Yuk Hui's theory of cosmotechnics. Through this synthesis, the research constructs a multidimensional analytical framework that links technological mediation, moral materialization, and the reconstruction of subjectivity. Within this framework, the study investigates how individual subjectivity and ethical responsibility are reconstructed in the process of technological acceptance, thereby revealing the intrinsic connections among technology, morality, and social structure.

In addition, the research focuses on the practical dimensions of ethical materialization and technological mediation in AIGC applications. Using cases such as AI voice assistants and virtual hospitals, it examines how these technologies regulate user behavior in everyday life and explores how morality can be embedded in design. These technologies not only fulfill functional needs but also, without relying on external moral constraints, guide ethical behavior through their design. The study further analyzes how such technologies, through their structures and functionalities, become carriers of moral action, thereby realizing the transfer and redistribution of ethical responsibility within

technological practices. Through this process, the research aims to demonstrate how AIGC technologies function as "ethical mediators", actively participating in the reconstruction of subjectivity and responsibility.

1.3.2 Research Methods

The research employs literature analysis, case studies, and comparative analysis.

Literature analysis surveys scholarship on AIGC acceptance, Verbeek's philosophy, mediation, and the materialization of morality. By reviewing classic and recent work, it identifies frameworks and points of contention and clarifies gaps and contributions.

Case studies examine concrete applications of AIGC to investigate how mediation and materialization function in practice. Through detailed analysis the study shows how mediation affects behavior, cognition, and social responsibility and how design can internalize norms that influence decision making.

Comparative analysis contrasts findings across technologies and ethical discussions and considers how cultural and social contexts condition mediation. This method evaluates applicability and limits in different settings and maps trends in technology ethics under globalization.

1.4 Research Value and Significance

1.4.1 Research Value

By deeply examining the social acceptance of AIGC technologies, particularly the interrelations among technological mediation, moral materialization, and the reconstruction of subjectivity, this study aims to make both theoretical contributions and practical insights to the field of techno-ethics.

First, the research fills a gap between AI studies and the philosophy of technology, especially through the application of Peter-Paul Verbeek's philosophy, thereby enriching the conceptual depth of technological mediation and moral materialization theories. At the same time, it integrates Don Ihde's postphenomenological perspective, Shannon Vallor's technomoral virtue ethics, and Yuk Hui's theory of cosmotechnics, thus constructing a multidimensional philosophical framework that provides a more systematic theoretical foundation for the ethical study of AIGC.

The study also shows how design can guide behavior without external moral compulsion and investigates the embedding of norms and the redistribution of responsibility through technology. This provides a rationale for the design of intelligent systems in fields such as artificial intelligence, the Internet of Things, and intelligent medicine and indicates how mediation can realize social value and moral goals.

The framework enriches understanding of complex relations in philosophy and ethics of technology and offers guidance for design practice, regulation, and social deployment. In an era of rapid change it is important to ensure that technology influences conduct in positive ways and develops in concert with social ethics.

1.4.2 Research Significance

The significance is theoretical and practical. Theoretically, the study offers a systematic discussion of the materialization of morality and technological mediation under AIGC and explores the practical reach of Verbeek's philosophy. By analyzing how design internalizes norms, it enlarges the theory of technology ethics and provides a new lens for future design and decision making.

Practically, the study provides ethical guidance for current AI design and application. As AI spreads, efficiency alone is not sufficient. Systems must meet ethical requirements. The analysis of mediation and materialization yields actionable guidance for developers so that AI can promote justice and well being.

1.5 Research Innovations and Limitations

1.5.1 Points of Innovation

First, the study connects Verbeek's mediation theory with the acceptance of AIGC and analyzes how AIGC influences behavior and social ethics through mediation and the materialization of morality. At the same time, the study incorporates multiple theoretical perspectives including postphenomenology, virtue ethics, and cosmotechnics, thereby forming a cross-theoretical and integrative framework within the philosophy of technology.

Second, it proposes ways to apply mediation and materialization in practice, especially in intelligent systems. Through concrete cases it shows how design can embed norms into structures and functions so that artifacts guide moral conduct. This informs design for social adaptability and moral soundness.

Third, the study is interdisciplinary. It combines philosophy of technology, ethics, sociology, and artificial intelligence and thus opens new perspectives for cross disciplinary research on AI ethics.

1.5.2 Limitations

Limits remain despite these contributions.

The theoretical framework is grounded in Verbeek's accounts of mediation and the materialization of morality. Applying these theories across diverse technologies and cultures requires further work. Acceptance and ethical judgment vary across societies. How to generalize within a global context remains a challenge.

The case studies focus on artificial intelligence and intelligent medicine. Other areas such as smart cities and digital health deserve attention. Future research should broaden the range of cases to explore applications of materialization and mediation in additional domains.

Finally, although the analysis engages theory in depth, empirical work on practical ethics and social impact is still limited. With ongoing advances in AI, more research is

needed to balance innovation and ethical norms and to ensure that mediation is morally sound and socially responsible in concrete deployments.

Chapter 2 Verbeek's Philosophy of Technology

2.1 Background to the Formation of Verbeek's Thought

2.1.1 Scientific Background

Peter Paul Verbeek, born on 6 December 1970 in Middelburg, the Netherlands, is a leading contemporary scholar in the philosophy of technology, ethics, and postphenomenology. He currently serves as Rector Magnificus of the University of Amsterdam and holds the chair in Ethics of Science and Technology in a Changing World. Verbeek earned his PhD in philosophy at the University of Twente. His dissertation, *De Daadkracht der Dingen* (2000), examines the relations among technology, philosophy, and design¹⁹.

Verbeek's research ranges across the philosophy of technology, postphenomenology, and ethics, with sustained attention to the ways technology mediates human behavior and social structures. His theory of technological mediation challenges traditional instrumentalism by arguing that technology functions as a medium that shapes human cognition, choice, and moral judgment. On this view, technology plays a central role in forming social behavior, cultural identity, and individual ethics. His major works include *What Things Do* (2005) and *Moralizing Technology* (2011). The former offers a philosophical reflection on technology, agency, and design. The latter analyzes how moral norms can be internalized in design.

¹⁹ Verbeek, P. P. (2001). *De daadkracht der dingen*.

Verbeek's philosophy responds to the profound impact of the twentieth century's scientific and technological revolutions and to the information age in particular, which has transformed patterns of cognition and behavior. In his framework, technology is no longer treated as a tool under human control. It acquires the capacity to mediate action and social order. His thinking is closely linked to technological change in the twentieth century and to the way information technologies have redefined relations between humans and the world and between humans and society. This redefinition stands at the center of his philosophical inquiry.

The technological revolutions of the twentieth century, especially the emergence of the information age, accelerated interactions between technology and society and culture. Advances in information technology, automation, and later artificial intelligence positioned technology not only at the core of material production but also at the heart of knowledge production, social interaction, and individual decision making. Traditional social structures, cultural identities, and moral outlooks have undergone dramatic change under this pressure. Verbeek's philosophy arose in this context and calls for a renewed examination of the complex interactions among technology, society, human cognition, and moral action.

With the spread of computers, the internet, and artificial intelligence, relations between humans and technology have changed in unprecedented ways. Technology has become deeply integrated into daily life. It alters perception, habits of thought, and patterns of behavior. The diffusion of information technology has reshaped notions of time and

space, loosened geographic constraints, and made globalization, instant communication, and data exchange routine. These shifts not only remake our relation to the external world but also prompt renewed reflection on the effects of technology on human subjectivity. For Verbeek, mediation is not a simple, tool like application. Through design and function, technology directly shapes cognition and conduct.

As information and automation technologies advance, the influence of technology extends beyond production and consumption into ethics, law, education, and other domains. Verbeek observes that such penetration means technology is no longer merely the product of human design and application. Through its functions and structures it mediates social behavior. In the information age, technology serves human needs while also acting as an intermediary that helps shape behavior and social order. His position invites us to view technology not as an external instrument but as an active participant in processes of social and cultural formation, with consequences for social values, moral judgment, and individual freedom.

Verbeek's philosophy thus took shape against the background of twentieth century technological revolutions. Through sustained reflection on the role of technology in society, he argues that technology is more than an extension of tools. By means of design, application, and structure it deeply mediates human behavior, cognition, and morality. His work addresses how modern technologies, especially information technologies, redefine cognition, behavior, and ethics, and it provides a new framework

for understanding the complex relations between technology and society and between technology and humanity.

2.1.2 Philosophical Background

Verbeek's theory of technological mediation draws on several philosophical traditions, most notably Don Ihde's postphenomenology, Bruno Latour's actor network theory, Maurice Merleau Ponty's ideas of the lived body and intertwining, and Michel Foucault's analyses of power and freedom. By integrating these resources, Verbeek develops a framework for explaining how technology mediates, shapes, and influences human behavior and social ethics.

(1) Don Ihde's postphenomenology and relations between humans and technology

Phenomenology provides a basis for analyzing the relation between technology and behavior, especially how technologies affect cognition and action. Phenomenology, one of the most influential philosophical movements of the twentieth century, was founded by the German philosopher Edmund Husserl. Its central aim is to uncover how human consciousness generates meaning through its relationship with the world. By calling for a philosophical "return to the things themselves," Husserl sought to move beyond the traditional epistemological divide between subject and object and instead focus on the structure of lived experience²⁰. Consciousness, he argued, is always intentional, that is, directed toward something, and this intentionality constitutes the intrinsic link between

20 Husserl, E. (1927). Phenomenology. Encyclopaedia Britannica, 14, 699-702.

the subject and the world. Phenomenology therefore concerns not only how we know the world, but also how the world is given through experience. This insight provided an important foundation for later philosophies of technology, allowing technology to be reinterpreted in phenomenological terms as a form of mediation that constitutes the human-world relationship rather than serving merely as a neutral instrument.

Don Ihde developed the distinctive framework of postphenomenology on the basis of this tradition. He inherited Husserl's theory of intentionality, Heidegger's notion of being-in-the-world, and Merleau-Ponty's ideas of embodied perception, while revising the transcendental and essentialist tendencies of classical phenomenology. Ihde argued that traditional phenomenology focused too heavily on the transcendental structures of subjectivity while neglecting the mediating role of technology²¹. Human experience, he claimed, is never "naked" or "pure"; it is always mediated by technological artifacts. Cameras, microscopes, computer interfaces, and artificial intelligence systems all reshape our relationship with the world. Postphenomenology therefore advocates an experience- and context-oriented approach, analyzing how specific technologies shape human perception, action, and culture.

In Ihde's view, technology is not an external instrument but a mediating existence that modulates the structure of human experience²². Mediation means that technology simultaneously reveals and conceals, empowers and constrains. Through technology, human perception is extended into new dimensions: the microscope reveals what is

21 Ihde, D. (Ed.). (1986). *Consequences of phenomenology*. State University of New York Press.

22 Ihde, D. (2008). Introduction: postphenomenological research. *Human Studies*, 31(1), 1-9.

invisible to the naked eye, while satellite imagery offers a view of the Earth from above. Yet this extension is accompanied by selective concealment, for what we perceive through technology is always a constructed world rather than a self-evident reality. Technology thus functions as a directed medium of intentionality, shaping how humans see, interpret, and act within the world.

Ihde proposed the model of four human-technology relations: embodiment, hermeneutic, alterity, and background relations²³. Embodiment relations occur when technology becomes an extension of bodily perception so that we perceive the world through it, as when glasses become transparent to the wearer. Hermeneutic relations describe technology as a symbolic representation of the world, such as a medical image or instrument reading that must be interpreted by humans. Alterity relations emphasize technology as a quasi-other that interacts with humans, as in the case of voice assistants or conversational robots that evoke emotional and moral responses. Background relations refer to technologies that recede from awareness but shape experience indirectly, such as algorithmic systems, smart homes, or surveillance infrastructures that influence our routines and decisions. Through this framework, Ihde revealed the multilayered and dynamic nature of technology within human experience.

This relational model becomes particularly salient in the context of contemporary Artificial Intelligence Generated Content (AIGC). When users create content with AIGC tools, the process of prompt writing, feedback, and regeneration forms an

23 Ihde, D., & Hanks, C. (2010). *A phenomenology of technics* (pp. 134-155). Chichester UK: Wiley-Blackwell.

embodied pattern of action in which users gradually learn to achieve creative goals through interaction with the model, and technology becomes an extension of thought and expression. The interpretation of generated results reflects a hermeneutic relation, as users "read" the model's textual or visual outputs and reprocess or refine them through understanding. When AI systems appear in conversational form and exhibit "memory" and "personality," users begin to perceive them as interactive partners, granting technology an alterity dimension. Meanwhile, background algorithmic recommendation, implicit moderation, and content filtering constitute a typical background relation, where users' choices are subtly guided by invisible parameters and system logic. These four types of relations continually shift and overlap during AIGC use, revealing how technological mediation profoundly shapes both subjectivity and creativity.

Building on Don Ihde's postphenomenology, Peter-Paul Verbeek proposed the theory of technological mediation, extending Ihde's experiential analysis to ethical and social dimensions. Verbeek argues that technology not only mediates human perception and behavior but also reshapes modes of moral judgment and responsibility distribution. Every technological artifact embodies certain value orientations and behavioral norms. For example, autonomous driving systems predetermine what counts as "ethical" behavior by setting safety thresholds, while AIGC's content generation mechanisms encode the boundaries of what is deemed "acceptable" or "unacceptable" through algorithmic rules. Technology thus becomes a form of moral materialization, whereby ethical principles are embedded in practice through design and function. This

perspective reveals how technology silently guides our choices and judgments, showing that "accepting" technology is not merely an operational act but an ethical engagement.

On this basis, Verbeek expands Ihde's human-technology relational model by introducing three new types of relations: cyborg relations²⁴, immersion relations, and augmentation relations (Table 1). Cyborg relations describe the fusion of humans and machines, as seen in cochlear implants or brain-computer interfaces, where humans and technologies form new hybrid agencies. Immersion relations emphasize the mutual responsiveness between humans and intelligent environments, such as virtual reality or smart spaces, where technology becomes an ambient condition of perception. Augmentation relations integrate embodiment and hermeneutic relations, as technologies both extend the body and serve as representational media, allowing perception and interpretation to occur simultaneously. These relations reveal the environmental character of contemporary technology and provide theoretical grounding for analyzing AIGC's pervasive integration into intelligent ecosystems.

Ihde	Embodiment relations	(Human-Technology) -> World
	Hermeneutic relations	Human -> (Technology - world)
	Alterity relation	Human-> Technology (-World)
	Background relation	Human-(-Technology/World)
Verbeek	Cyborg relation	Human/Technology -> World
	Immersion relation	Human <-> Technology/World

24 Verbeek, P. P. (2008). Cyborg intentionality: Rethinking the phenomenology of human–technology relations. *Phenomenology and the cognitive sciences*, 7(3), 387-395.

	Augmentation relation	(Human - Technology) -> World Human -> (Technology - World)
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Table 1. Idhe's and Verbeek's Classification of Human-Technology Relations

From a postphenomenological perspective, the social acceptance of AIGC is not a linear process in which technical functions passively adapt to user needs but rather a dynamic mechanism through which human-technology relations are reconstructed and stabilized within specific social contexts. Cultural differences play a crucial role in this process. In cultures that emphasize personal autonomy and privacy protection, technology is often regarded as a tool that must be constrained. In cultures that value collective responsibility and social harmony, technology tends to be seen more positively as a means of safeguarding public welfare. Thus, "acceptance" is not an inherent property of technology itself but a process of social negotiation and ethical mediation.

Postphenomenology also offers valuable methodological insights for this research. First, it emphasizes beginning from embodied experience and using phenomenological description to analyze how technology intervenes in human cognition and behavior. Second, it advocates contextualized comparative analysis, examining how technologies manifest diverse relations within different cultural and social environments. Third, it encourages treating design as an ethical practice, tracing how values are materialized into operational logic through detailed analysis of technical scripts, user interfaces, and system parameters.

Nevertheless, postphenomenology faces certain criticisms. Its tendency toward technological positivity may sometimes underestimate the potential threats technology poses to human autonomy. When technological transparency becomes invisibility, and when algorithms shape behavior and cognition through high degrees of automation, subjectivity risks being diminished. In the case of AIGC, users may become dependent on convenience and efficiency, leading to a form of de-agency. Therefore, analyses of technological mediation must incorporate a critical perspective, attending to asymmetries of power, shifts in responsibility, and the ambiguity of ethics.

In conclusion, Don Ihde's postphenomenology not only provides a foundational framework for analyzing human-technology relations but also offers theoretical and methodological tools for understanding the social acceptance of AIGC. Through the four relations of embodiment, hermeneutic, alterity, and background, together with Verbeek's additional relations of cyborg, immersion, and augmentation, we can systematically uncover how technology mediates subjectivity, materializes values, and redistributes responsibility across cultural and ethical dimensions. This analytical framework serves as a key theoretical foundation for this study's exploration of AIGC's logic of acceptance, the reconstruction of subjectivity, and the development of an ethics-oriented design framework.

(2) The Hybrid Character of Human-Thing Relations in Bruno Latour's Actor Network Theory

In the 1980s, Bruno Latour introduced the Actor-Network Theory (ANT), marking a significant reorientation in modern social science. This theory breaks away from anthropocentric paradigms of analysis and seeks to move beyond binary divisions such as subject versus object or society versus nature. Latour proposed that humans and nonhumans—including technologies, material artifacts, institutions, and symbols—together constitute a dynamic, continuously evolving network²⁵. Within this theoretical framework, "actors" are not limited to conscious individuals; they also include technological artifacts, algorithms, machines, documents, institutions, and semiotic systems. All of these entities possess agency, meaning they can exert influence within the network and alter the states or actions of other actors. In this sense, Latour advocates generalized symmetry, asserting that there is no ontological hierarchy between humans and nonhumans.

Latour's Actor-Network Theory emphasizes the relational and generative nature of action. Action does not originate from an isolated subject but is continuously "translated" within a web of relations. The agency of each actor emerges through its connections and interdependencies with others. In his influential works *We Have Never Been Modern*, Latour argues that one of modernity's central misconceptions is the separation of nature from society and matter from meaning²⁶. In reality, all social phenomena are hybrid formations. What we call "facts," "technologies," or "institutions" are merely temporary stabilizations produced by ongoing processes of

25 Latour, B. (1992). One more turn after the social turn: Easing science studies into the non-modern world. *The social dimensions of science*, 292, 272-94.

26 Latour, B. (2012). *We have never been modern*. Harvard university press.

translation and mutual conditioning among heterogeneous actors. Society, therefore, is not constructed by humans alone but is the emergent outcome of networks woven jointly by humans and nonhumans.

To reveal how this hybridity operates, Latour proposed the key concept of translation. Translation, in this sense, refers not only to the transfer of meaning but also to the negotiation and interaction among actors²⁷. For example, when a person kills someone with a gun, is it the person who kills or the gun? Latour contends that this question is fundamentally misguided, for the act of killing arises only within the network formed by the human and the gun. The human provides intention and direction, while the gun contributes force and material structure; neither alone constitutes the act. Human and gun are both actors, and through the process of translation they form a new composite agency. As a result, the human becomes a "murderer," and the gun becomes a "weapon," each acquiring a new role and semantic status. This shows that an actor's identity is not predetermined but dynamically generated within specific networks.

In Latour's view, technological means and ends are inseparable. The purpose of a technology is often "hidden" within its operational form, a phenomenon he calls the under-ego of technology²⁸. Every technological artifact embodies implicit moral or behavioral prescriptions: a speed bump demands that drivers slow down, a seatbelt enforces compliance with safety norms, and a handcart requires the user to push in a particular bodily posture. Technological artifacts are therefore not passive objects but

27 Muecke, S. (2024). Bruno Latour and translation. *Theory, Culture & Society*, 41(5), 97-104.

28 Latour, B., & Venn, C. (2002). Morality and technology. *Theory, culture & society*, 19(5-6), 247-260.

material configurations that carry normative, social, and moral expectations within their very design. In this way, ethics and technology are not separate domains but are interwoven within every act of material design and practical use.

Actor-Network Theory thus promotes a form of relational ontology. Existence is no longer understood as an intrinsic property of entities but as the product of relations. An actor derives its meaning and agency only through its interactions within a network. This relational ontology offers a new way to reconceptualize the relationships among humans, artifacts, and society. Technology is not a neutral instrument but an active component of social order and moral practice. ANT therefore rejects the idea of technology as a mere medium, insisting instead that technologies are scripted and value-laden, participating in social construction through their material agency.

Inspired by Latour's insights, Peter-Paul Verbeek further developed the concept of the moral materialization of technology. While Latour exposed the agency of things, Verbeek extended this idea into the ethical domain. Building on and modifying Latour's concept of the script, Verbeek argues that every technological design embeds certain choices that guide, constrain, and regulate user behavior. Each design carries a moral intention: for instance, the automatic car-locking mechanism externalizes the responsibility for safety; the timing functions in online learning systems impose normative expectations about "study time"; and AIGC systems encode social values into their operation by implementing filters and content moderation mechanisms²⁹.

29 Verbeek, P. P. (2006). Materializing morality: Design ethics and technological mediation. *Science, Technology, & Human Values*, 31(3), 361-380.

Technological scripts thus become material forms of moral practice, shaping the boundaries and meanings of human action.

Within the framework of Actor-Network Theory, moral action can likewise be seen as the collaborative outcome of multiple actors within a network. Human intentions and technological functions interlock to generate new ethical consequences. For example, AIGC systems incorporate features such as "safety thresholds," "bias detection," and "human review." These seemingly technical mechanisms are in fact algorithmic embodiments of social ethical principles. When users interact with such models, moral action is no longer solely the result of human decision-making but the co-produced outcome of humans, algorithms, data, and interfaces. This distributed character of morality represents one of ANT's most significant contributions.

Actor-Network Theory and postphenomenology share deep resonances. Both reject the traditional subject-object dualism and emphasize the co-constitutive relations between humans and technologies. However, their emphases differ: postphenomenology focuses on the experiential "how" of human-technology relations—that is, how technologies mediate perception and practice—whereas ANT focuses on the relational "why," analyzing how such mediations are achieved through network structures. The former begins from lived experience, offering an "inside-out" situational analysis; the latter begins from systems of relations, offering an "outside-in" account of network formation. The integration of these two perspectives enables Verbeek to address the complex

interplay between experience and structure, ethics and materiality, and action and design within the philosophy of technology.

Latour's theory also resonates with Alfred North Whitehead's process philosophy, which conceives the world not as composed of static substances but of events and relations³⁰. Reality, for Whitehead, consists of interconnected processes of becoming. Latour adopts this monistic relational perspective and recontextualizes it within the social sciences as the actor-network. In this sense, the agency of humans and nonhumans is not a symmetrical duplication but a co-generative process—a dynamic flow in which temporary structures emerge through interaction and are continually reorganized.

However, Verbeek does not fully accept Latour's notion of radical symmetry. While both humans and artifacts constitute the conditions of action within networks, they do not possess identical moral agency³¹. Technology may influence behavior, but it cannot replace human moral reflection or responsibility. Verbeek therefore advocates a form of interactive co-constitution, wherein humans and technologies mutually shape one another while maintaining distinct modes of existence and ethical standing. Through this reformulation, ANT acquires a new ethical dimension in Verbeek's framework: it becomes not merely a descriptive methodology but a normative resource for understanding how technology participates in moral life.

30 Latour, B. (2008, September). A cautious Prometheus? A few steps toward a philosophy of design. In "Networks of Design", Annual International Conference of the Design History Society (pp. 2-10). Universal Publishers.

31 Verbeek, P. P. (2006). Acting artifacts: The technological mediation of action. In *User Behavior and Technology Development: Shaping Sustainable Relations Between Consumers and Technol* (pp. 53-60). Dordrecht: Springer Netherlands.

From Latour to Verbeek, technology is no longer conceived as an external appendage to society but as an integral component of social and ethical order. Technology acts as a participant in action, a generator of meaning, and a mediator of morality. Humans and technologies together form an open, fluid hybrid network in which responsibility, value, and agency are constantly redistributed. The hybridity revealed by Actor-Network Theory not only underpins Verbeek's ideas of technological mediation and moral materialization but also provides a crucial philosophical foundation for this study's exploration of subjectivity reconstruction in the social acceptance of AIGC.

(3) Merleau Ponty's Concepts of the Lived Body and Intertwining

Maurice Merleau-Ponty, within the phenomenological tradition, fundamentally revised the dualism between mind and body. He criticized the classical philosophical framework that separates subject and object, spirit and matter, and argued that meaning is not assigned to the world by an isolated mind but emerges in the reciprocal process of perception and action³². The human being is not a consciousness "inside" a body but an embodied being-in-the-world; the body is not an external instrument but the medium through which meaning is co-constituted between human and world. In this sense, perception itself possesses intentionality. Through posture, touch, gaze, movement, and stillness, the body continuously incorporates the world into an experiential structure.

In *The Visible and the Invisible*, Merleau-Ponty introduced the concept of "flesh", which breaks through the opposition between the "subjective body" and the "objective

32 Merleau-Ponty, M., Landes, D., Carman, T., & Lefort, C. (2013). *Phenomenology of perception*. Routledge.

body." Flesh is neither pure matter nor pure consciousness, but the primordial fabric in which subject and world are interwoven and externally related³³. Through the body we touch things, and at the same time we are seen and touched by others. The body thus has a double manifestation: it is both the source of perception and action, and the object that can be perceived, acted upon, and transformed by technology. This duality is not contradictory but constitutes the phenomenological condition of appearance.

Accompanying the idea of flesh is that of "chiasm", which describes the interpenetration between subject and world, and between subject and other. When I look at the world, the world simultaneously shapes my seeing through its visibility. When I touch an object, the object, through its tangible quality, defines the contours of my tactile experience. Seeing and being seen, acting and being acted upon, interior and exterior are no longer absolute opposites but interdependent positions that alternate within this intertwining. Meaning, therefore, does not arise from a purely subjective act of projection or from an objective process of inscription; it is jointly manifested within the intertwining of embodied experience.

In *Phenomenology of Perception*, Merleau-Ponty illustrated this intertwining through the famous case of the blind man's cane³⁴. At first, the cane is perceived as an object. With practice, it recedes from awareness and becomes a transparent medium through which the tactile field extends into the environment. The user no longer feels the cane itself but feels through it and reaches directly toward the world. In similar fashion,

33 Merleau-Ponty, M. (1968). *The visible and the invisible: Followed by working notes*. Northwestern University Press.

34 Merleau-Ponty, M., Landes, D., Carman, T., & Lefort, C. (2013). *Phenomenology of perception*. Routledge.

clothing, tools, devices, and technological interfaces can become incorporated into one's embodied schema through practice. Embodiment is not an external layer but the process by which external things are sedimented into bodily patterns of action, transforming how we encounter the world.

On this basis, Merleau-Ponty proposed the concept of the intentional arc, which describes how the body integrates past habits, present postures, future expectations, and the background of culture and morality into a continuous circuit of perception and action. The intentional arc is not an abstract mental program but a field of tension where body and world resonate. It determines what we notice, how we act, and what we care about. When new technologies enter practice, the intentional arc is reconfigured: new rhythms of operation, altered feedback intervals, and redistributed affordances reshape the structures of human directedness.

Building on these insights, Peter-Paul Verbeek developed the idea of a technologically mediated chiasmic structure³⁵. Technology is not an external bridge added between subject and world but is embedded within the intertwining itself, altering the relations between seeing and being seen, touching and being touched, speaking and being responded to. Technology extends the intentional arc by enabling more sensitive perception and faster action, while also constraining it through defaults, thresholds, scripts, and filters that define which actions feel smooth and which encounter resistance.

35 de Boer, B., & Verbeek, P. P. (2022). Living in the flesh: Technologically mediated chiasmic relationships (in times of a pandemic). *Human studies*, 45(2), 189-208.

The intertwining is therefore not neutral. It has direction, rhythm, and density, all of which contribute to the reconfiguration of subjectivity.

The integration of technology into this intertwining also rewrites the structure of ethics. Verbeek's concept of materialization of morality, explains that norms do not exist only in external rules or internal beliefs but are materialized in interface layouts, interaction logics, accountability pathways, and systems of moderation and control. Design thus becomes the material grammar of moral practice, determining what kinds of action are possible and appropriate. Ethics and technology are not parallel realms but are entangled and co-constituted within the fabric of embodied experience.

Placed in the context of AIGC, these ideas illuminate how the intertwining is technologically rewritten. In the process of text or image generation, the cycle of prompting, system feedback, and re-prompting gradually becomes a bodily schema for creators. The ways of asking questions, the timing of pauses, the judgment of completion, and the distribution of attention are all shaped by the rhythm of the interface, the density of output, and the modes of visualization. The interpretive dimension arises when users read the generated content. They are not passive receivers but participants who co-create meaning with the system. Conversational AIGC systems introduce a form of alterity, as users feel they are interacting with an entity that can respond, remember, and understand intent. At the same time, background processes of recommendation and filtering continuously shape the information environment, turning background relations into a dominant experiential horizon.

Throughout this process, subjectivity is not static. The intentional arc is reorganized through its interaction with AIGC: attention is redistributed, evaluative anchors shift, and the sequence of drafting, revising, and finalizing is compressed or rearranged. The boundaries between originality, rewriting, and synthesis become more fluid. This transformation does not mean the disappearance of the subject but the emergence of a new collaborative posture between human and technology. From Merleau-Ponty's perspective, this is a reweaving of embodiment itself. We use technology as a shuttle that reconfigures the texture of our relations with the world and with others.

The intertwining becomes especially important in AIGC because it brings ethical questions back to the level of lived experience. Design choices such as content filtering, attribution, bias mitigation, and dialogue safety are not external layers of regulation but integral elements of the entire process of input, generation, presentation, and distribution. They determine which paths are possible and which are excluded. Materialized morality appears in visible warnings, hidden thresholds, feedback timing, human review points, and the traceability of prior interactions. Ethics thus acquires a tangible thickness rather than remaining an abstract set of principles.

For methodology, Merleau-Ponty's approach suggests a micro-phenomenological strategy. It involves first-person descriptions that capture the rhythm of using, viewing, and modifying; the movement of hands and gaze; the temporal sense of waiting and anticipation; and the moments when the feeling of authorship or control emerges or is lost. These experiences can then be mapped onto concrete interface elements such as

delay, preview windows, buttons, prompts, default parameters, and explanatory labels, outlining the topology of the human-technology-world intertwining. Comparative studies across cultures and contexts can further reveal how moral materialization and acceptance logic are differently coupled.

Nevertheless, the technologization of intertwining entails risks. When mediation becomes too seamless, users may slip into a state of unawareness and lose agency. When interfaces become overly anthropomorphic, responsibility may blur and shift from humans to systems. Therefore, analysis of technological mediation must include a critical dimension, emphasizing explainability, accountability, and human-in-the-loop safeguards to preserve agency and ethical clarity within technological intertwining.

From a broader cultural perspective, the structure of flesh and intertwining exhibits different moral densities in different social contexts. In societies that emphasize individual autonomy and privacy, design focuses on controllability at the interface level and restraint in the background systems. In societies that prioritize collective security or public order, design tends to rely more on proactive environmental feedback and predefined external constraints. These variations explain why AIGC acceptance follows multiple localized trajectories rather than a single model.

In summary, Merleau-Ponty's concepts of flesh and intertwining provide the phenomenological foundation for Verbeek's theory of technological mediation. Technology is not external to the subject but participates in the very constitution of subjectivity. Verbeek's technologically mediated chiasmic structure advances this

insight into the ethical and design dimensions, showing how norms are materialized within embodied, interpretive, alterity, and background relations. In the context of AIGC, these dynamic relations concretely illustrate the processes of subjectivity reconstruction, redistribution of responsibility, and ethics-oriented design. Based on this framework, the present study addresses three central questions: how cultural, ethical, and social factors jointly shape the logic of technological acceptance; how subjectivity and ethical responsibility are rewritten through technological mediation; and how ethical principles and social responsibility can be integrated into the design and interaction processes of AIGC.

(4) Foucault's Views on Power and Freedom

Michel Foucault's thought on subjectivity and power provides a crucial perspective for rethinking, under technological conditions, the question of what kind of subjects we wish to become³⁶. In contrast to traditional conceptions that treat the subject as a self-sufficient origin of agency, Foucault situates subjectivity within the dynamic interplay of power and knowledge. The subject does not preexist and then become influenced by external forces; rather, subjectivity is continuously formed, tested, and regulated through norms, institutions, and practices (Foucault, 1997). This perspective does not deny freedom; it redefines it as a historically produced practice that emerges within power relations rather than as an innate essence.

³⁶ Foucault, M. (2012). *Discipline and punish: The birth of the prison*. Vintage.

In Foucault's genealogical account, power is not a top-down mechanism of repression but a diffuse network of micro-practices that operate at the everyday level of social life³⁷. Mechanisms of order, discipline, evaluation, supervision, and normalization organize the subject's time, space, perception, actions, body, and desire through disciplinary power and biopower. The panopticon, in this view, is not only a surveillance apparatus but a relational mechanism of being seen and seeing oneself, through which individuals internalize visibility and engage in self-regulation. Freedom, therefore, is not the absence of power but the reflective space that emerges through living within power.

Foucault's revaluation of freedom centers on the idea of freedom as practice. Freedom is not an abstract state of "being free from" but a concrete mode of "how"-how, within a given configuration of power, one works upon oneself through technologies of the self to shape a particular art of living. Ethics, in this sense, is not grounded in an innate moral essence but in the ongoing practices of care of the self and self-formation. The subject does not stand outside power but is co-constituted with it: power provides the terrain of action, and freedom carves paths within it.

When brought into the technological context, particularly in dialogue with postphenomenology, this perspective allows us to understand technological mediation as a central site of subject formation. Technology organizes visibility, determines rhythms, and embeds thresholds; through interface strategies that differentiate between

37 Foucault, M. (1997). The ethics of the concern for self as a practice of freedom. *Ethics: Subjectivity and truth*, 1, 281-301.

what can and cannot be done, between what feels seamless and what generates friction, it writes the grammar of possible actions. Technology thus functions as a form of governmentality, a "conduct of conduct" that governs behavior while teaching subjects to govern themselves in particular styles. Freedom is not something outside technology but a practical capacity learned, exercised, and renewed within the relational field of technology and norms.

If technological determinism emphasizes the domination of tools over humans, and social constructivism emphasizes human meaning-making, then Foucault offers a third path: within the *dispositif* (apparatus), power produces subjects through the channels of knowledge and technology. Algorithmic recommendation, default settings, threshold control, memory strategies, explainability, and pathways for appeal are not neutral technical features but concrete forms of norms in action. Consequently, the central question is not whether technology restricts the subject but how the subject practices freedom within technological governance. The challenge is not to escape the apparatus but to create within it spaces of reflection, revision, and negotiation.

At this point, Foucault's framework converges with Peter-Paul Verbeek's philosophy of technology. Verbeek does not accept the idea that technology engulfs subjectivity. Instead, he argues that technological mediation, by redistributing visibility, accessibility, and accountability, transforms the relationships between subject and other, and between subject and world³⁸. Morality is no longer a set of external rules or merely

38 Verbeek, P. P. (2024). *Moralizing technology: Understanding and designing the morality of things*. University of Chicago press.

an inner conscience; it is also materialized in built-in scripts, thresholds, safeguards, and traceable chains of responsibility. The materialization of morality thus refers to the transformation of norms into tangible, actionable, and accountable technical conditions, giving the subject concrete means to become a certain kind of moral agent in practice.

Within the context of AIGC, these relations become particularly visible. When the rhythm of "prompt-feedback-re-prompt" establishes a habitual pattern, users' attention and judgment are organized by the cadence of the interface. When safety thresholds, sensitive-word filters, and response levels permeate the generation process, users adapt their strategies accordingly. When the system presents itself as an interactive other, the subject simultaneously gains and yields agency. The key issue is not whether users are "controlled," but how they practice authorship and judgment within the organized structures of visibility and accessibility. Examples include embedding authorship and traceability as default features, integrating human review at key decision points, and offering counterfactual exploration or diverse sampling as pathways of freedom.

Freedom in the Foucauldian sense does not mean absence of technology; it means being free within technology. This shifts the primary concern of ethics from principle to practice: rather than presupposing a pure, autonomous subject unaffected by technology, we must ask how subjects, within specific apparatuses, exercise reflection, choice, and self-discipline to create better ways of living. Verbeek therefore contends that technological mediation does not negate freedom; rather, good mediation enables

freedom in practice. Freedom becomes not an abstract slogan but a cultivated capacity that can be trained, maintained, and held accountable.

In this light, limitation and empowerment are two sides of the same process. The apparatus shapes action through constraints, but those very constraints open directional spaces for agency. The ethical task of design is not to remove limits but to make limits negotiable, reversible, adjustable, and escapable. This is how Foucault's "technologies of the self" can be translated into engineering and design: by creating interpretive channels and appeal nodes that support subject formation, by offering multiple generation-filtering-regeneration routes that support practical freedom, and by establishing traceable authorship and attribution systems that support responsibility³⁹.

Reconsidering the question "does technology make humans passive" from this standpoint reveals that the dichotomy it presupposes is obsolete. The relation between subject and technology is not a simple axis of domination or submission but a woven network of mutual influence. Within this network, the subject is both organized and organizing, both trained and training, both regulated and regulating. Freedom is not a final state but a style of action, not a destination but a continual exercise. Such freedom depends on conditions of explainability, transparency, auditability, appealability, and shared human-machine governance, unfolding within a bidirectional structure of seeing and being seen.

39 Foucault, M., Martin, L. H., Gutman, H., & Hutton, P. H. (1988). *Technologies of the self*. London: Tavistock.

Furthermore, Foucault's idea of an aesthetics of existence reminds us that neither freedom nor goodness is guaranteed by abstract principle; both arise from the subject's formation within concrete relations. For AIGC, this means that ethics is not merely a compliance checklist but an educative project of authorship and judgment. Prompt engineering becomes a form of training; comparison, counterfactual exploration, and alignment serve as exercises; annotation and revision constitute techniques of the self; design and governance form the external conditions. This approach does not abandon critique but transforms it into an actionable critique.

Accordingly, Verbeek's understanding of freedom shifts from autonomy to relational freedom. Freedom is no longer defined as independence from influence but as the capacity to cultivate better relations within influence. Technological mediation matters not because it imposes order but because it provides embodied and accountable ways of engaging with others and with the world. Freedom thus becomes inseparable from design. A well-designed apparatus does not isolate the subject from power but preserves spaces for modification, hesitation, and reflection within power.

Placed back within the framework of this study, Foucault's thought clarifies the practical trajectory of the three research questions. In Q1, the logic of technological acceptance is not a sum of attitudes but a configuration among power, norms, apparatus, and subject. In Q2, subjectivity and responsibility are redistributed through technological mediation, and the subject practices freedom through self-technologies within regulation. In Q3, ethical design is not an external layer but an aesthetic of

apparatus, composed of scripts, thresholds, safeguards, appeals, and accountability mechanisms. In this sense, Foucault transforms freedom from a metaphysical declaration into an engineering and institutional task; Verbeek realizes this task at the levels of interface and process; and AIGC becomes the contemporary field where this task is tested, contested, and refined.

2.2 Core Concepts in Verbeek's Philosophy of Technology

2.2.1 Verbeek's Theory of Technological Mediation

Technological mediation is one of the core concepts of Verbeek's philosophy. It holds that in contemporary society technology functions as a profound mediator of cognition, behavior, and social interaction. In contrast with instrumentalism, Verbeek stresses that technologies, through design and use, exert far reaching effects on perception, action, and social structures⁴⁰. Technologies do more than alter the physical world. They shape how people experience and understand the world and thereby influence modes of action and social relations.

Traditionally, technology was treated as an external tool that raises productivity or satisfies needs. Drawing on postphenomenology, Verbeek challenges this simplification. Technologies serve human purposes, yet at the same time they directly

40 Verbeek, P. P. (2005). *What things do: Philosophical reflections on technology, agency, and design*. Penn State Press.

modulate perception, conduct, and social interaction through design and use. While meeting needs, they subtly form styles of life, patterns of thought, and cultural cognition.

In this account, technology mediates the relation between humans and the world. Interaction with the world occurs through the bridge of technological artifacts as well as through the senses⁴¹. By virtue of material form and functional design, technologies influence how the world is understood and experienced. With smartphones and social media, for example, design goals extend beyond efficiency to the modulation of communication, information access, and behavior. The salient effects arise not only from explicit functions but also from implicit design that reshapes cognition, decision making, and conduct over time.

Mediation reaches into deeper layers of social structure and cultural cognition. Widespread technologies have altered modes of information access and transformed the treatment of time, space, and even identity. Design choices in smart devices such as reminders, interaction patterns, and social algorithms gradually form rhythms of life and habits of behavior. Technology becomes an ever present participant in daily life that influences relations with others and with the world.

In this view, technology is no longer neutral. It acts as an intermediary that affects cognition, behavior, and social interaction. Design determines functions, yet it also shapes ways of living and structures of understanding. The relation is not one way.

41 Verbeek, P. P. (2015). COVER STORY beyond interaction: a short introduction to mediation theory. *interactions*, 22(3), 26-31.

Technologies meet human needs and in turn reshape those needs and behaviors. This reciprocal interaction confers moral relevance on artifacts and renders design a social practice that helps construct norms, identities, and values⁴². The core task is to understand how design and function exert indirect yet deep influence on conduct. Verbeek's theory offers a philosophical basis for analyzing how technologies shape individual behavior, cultural identity, and social order, and it supplies guidance for assessing ethical issues in areas such as virtual and augmented reality and artificial intelligence.

2.2.2 The Materialization of Morality

Verbeek's concept of the materialization of morality shifts perspectives in the philosophy of technology. It reexamines the moral role of artifacts and unsettles simplified views of tools in ethics. Materialization refers to the embedding of moral norms into functions and structures during design so that, in use, artifacts guide and regularize behavior and perform moral functions⁴³. On this view, technology is not a passive means to human ends. Through internalized design mechanisms, it actively modulates patterns of behavior, modes of cognition, and forms of social interaction.

The central idea is that artifacts can carry moral and social responsibility through design.

Designers can embed ethical norms in structures and functions so that, without external

42 de Boer, B., & Verbeek, P. P. (2022). Living in the flesh: Technologically mediated chiasmic relationships (in times of a pandemic). *Human studies*, 45(2), 189-208.

43 Verbeek, P. P. (2024). *Moralizing technology: Understanding and designing the morality of things*. University of Chicago press.

enforcement, artifacts guide behavior by means of internal features. Implicit functions and structural choices can automatically adjust and regularize conduct, which allows moral norms to operate during use.

Examples include energy saving defaults in smart homes that encourage conservation while meeting comfort needs, security features in payment systems, and privacy mechanisms on social platforms. In such cases, design internalizes moral responsibilities within technical functions. Users follow norms while pursuing ordinary tasks, and design influences choices and interaction without overt command.

Materialization therefore makes the product itself part of moral regulation. Automated mechanisms implement norms without reliance on external oversight or individual resolve. This reveals the depth of technological influence on social behavior and highlights the responsibilities of design. In Verbeek's framework, functions serve needs and at the same time carry moral significance. They shape patterns of conduct, ethical judgment, and social understanding⁴⁴.

However, Shannon Vallor's theory of technomoral virtue ethics provides an important supplement and extension to Verbeek's concept of moral materialization. Vallor argues that morality can not only be embedded within technology but should also be cultivated and practiced through human interaction with it⁴⁵. In her view, technology is not merely

44 Verbeek, P. P. (2009). The moral relevance of technological artifacts. In *Evaluating New Technologies: Methodological Problems for the Ethical Assessment of Technology Developments*. (pp. 63-77). Dordrecht: Springer Netherlands.

45 Vallor, S. (2016). *Technology and the virtues: A philosophical guide to a future worth wanting*. Oxford University Press.

a vessel for moral behavior but a medium through which human beings can cultivate virtues. She proposes that in a world where humans and technologies coexist and evolve together, individuals should develop new technomoral virtues such as honesty, prudence, empathy, and responsibility through ongoing practice and reflection. These virtues are not passively shaped by technology but emerge from the individual's continuous engagement, moral exercise, and judgment within technological environments.

This perspective complements Verbeek's notion of moral materialization. While Verbeek emphasizes how moral norms are inscribed in technological design, Vallor focuses on how moral subjects grow within technological contexts. She cautions that if moralized technologies only prescribe user behavior without leaving room for moral judgment and reflection, they may weaken moral autonomy. Therefore, she advocates that in designing ethically oriented technologies, users should also be given the opportunity to practice virtue and cultivate moral wisdom (*phronesis*) within technological mediation.

In traditional ethics, moral norms have typically depended on external social constraints, legal regulations, or the individual's internal sense of duty, while technology has merely served as an external tool providing convenience and functionality. Through the process of moral materialization, however, technology becomes capable of embedding moral norms within itself and enabling the automated regulation of ethical behavior. For example, an intelligent waste-sorting system, equipped with sensors and voice prompts

at disposal points, guides users to discard items in accordance with environmental standards. Facial recognition gates in public transportation not only function as ticket-checking tools but also implicitly reinforce social norms against fare evasion. Similarly, automated borrowing and return systems in libraries, through mechanisms such as automatic late fees, integrate the norm of "returning items on time" directly into the technological process. Behind these technologies, designers have already internalized specific moral expectations into the functions of the systems. As a result, users, in the course of everyday use, begin to follow these norms unconsciously, thereby achieving the automation of moral behavior through technological mediation.

Verbeek's concept of moral materialization not only provides a new theoretical framework for understanding the complex relationship between technology and ethics but also offers critical guidance for how designers can integrate moral norms into technological development⁴⁶. With the rapid advancement of intelligent technologies, artificial intelligence, and big data, traditional ethical theories and decision-making models often struggle to keep pace with these emerging transformations. Against this backdrop, moral materialization presents an innovative approach for technology ethics, encouraging designers to move beyond purely functional considerations and to embed moral norms and social responsibilities into the design and implementation of technologies.

46 Verbeek, P. P. (2009). The moral relevance of technological artifacts. In *Evaluating New Technologies: Methodological Problems for the Ethical Assessment of Technology Developments*. (pp. 63-77). Dordrecht: Springer Netherlands.

From Vallor's perspective, the future of technology ethics should not rely solely on morality in design but must also emphasize virtue in use. Technology is both a material embodiment of moral norms and an environment and opportunity for ethical growth. The complementarity between Verbeek and Vallor demonstrates that a truly sustainable framework for technological ethics requires technology to assume normative responsibility while also preserving human space for reflection and moral development, thereby enabling the co-generation of subjectivity and morality within technological contexts.

Through moral materialization, technology is no longer a mere tool for enforcing external moral rules but becomes an intrinsic driver of moral behavior. The design and functionality of technology can regulate user behavior not through external supervision or coercive norms, but through internalized mechanisms that promote self-regulation of ethical conduct. Verbeek's theory of moral materialization thus provides a new lens for understanding how modern technologies profoundly influence human behavior, shape social norms, and drive ethical transformation.

It not only expands the intersection of philosophy of technology and ethics but also offers a practical pathway for ethical design and practice in contemporary technological societies. Within the modern technological landscape, Verbeek's notion of moral materialization possesses both profound theoretical significance and practical applicability. It calls on designers to carefully consider the moral implications of technological systems and to ensure that technology can, often imperceptibly, promote

the realization of social values while fostering healthier behavioral patterns and cultural awareness in society.

2.2.3 Social Impacts of Technological Mediation

Technological mediation concerns changes in individual behavior and cognition and also reaches social structures, cultural identities, and collective conduct. It raises new questions about the distribution of ethical and social responsibility⁴⁷. As technologies advance, especially artificial intelligence, information technology, and automation, mediation becomes increasingly salient in the formation of ethics, norms, and responsibility.

First, mediation shapes social norms. With the spread of information and digital technologies and AI, patterns of social interaction have shifted. Communication is more efficient, yet the forms of association have changed and relations between individuals and society have been reconfigured. Through design, technologies modulate habits, modes of information consumption, channels of communication, and the construction of social circles. These shifts influence collective behavior and cultural understanding.

Social media platforms illustrate this process. Algorithmic curation alters the flow of information and shapes how users understand events and cultural products. Seemingly simple interfaces carry mediations that change habits of information seeking, styles of

47 Verbeek, P. P. (2010). Accompanying Technology: Philosophy of Technology after the Ethical Turn. *Techné: Research in Philosophy & Technology*, 14(1).

expression, and even value commitments. The effects reach beyond individual life into structures of society and cultural identity.

Second, mediation redistributes ethical and social responsibility. As artifacts guide conduct, questions arise about responsibility. In domains such as AI decision making, technologies now play a major role in action guidance. When results affect fairness or individual rights, how should responsibility be assigned? Should it be attributed to designers, users, the artifact, or the firm that deploys it? Traditional models of responsibility are strained when artifacts become active factors in decision and norm formation. Verbeek's account highlights the need to reassess responsibility relations among designers, institutions, and individuals when products act as guides to conduct.

Third, mediation interacts with inequality and power. Design and application often reflect the values and interests of particular groups. Mediation can widen divides or deepen imbalances of power⁴⁸. Some innovations diffuse primarily within certain groups while bypassing others, which enlarges the digital divide and intensifies inequality. Under globalization, digital technologies and AI may serve firms that concentrate technical and financial capital while neglecting local or vulnerable groups. Data bias and opaque algorithms can disadvantage those already at risk. These tendencies can unintentionally reinforce social distance and consolidate existing structures of power.

48 Kroes, P., & Verbeek, P. P. (2013). Introduction: The moral status of technical artefacts. In *The moral status of technical artefacts* (pp. 1-9). Dordrecht: Springer Netherlands.

Verbeek's theory urges critical reflection on these dynamics. Technology is a driver of social change and at the same time a component of social and cultural structures with significant ethical implications. Mediation shapes conduct, redefines responsibility, and interacts with inequality. Understanding these processes is essential for evaluating the ethical and social role of technology and for guiding design and governance toward fairness and justice.

2.3 Contemporary Applications and Challenges of Verbeek's Philosophy of Technology

2.3.1 Contemporary Applications

Verbeek's philosophy of technology, especially his theory of technological mediation and the idea of the materialization of morality, has found wide application across many sectors of contemporary society. In the context of intelligent technologies, artificial intelligence including AIGC, big data, and the Internet of Things, his work offers a framework for understanding the complex interactions among technology, society, and ethics.

In the design and deployment of intelligent systems and AI, technological mediation provides guidance for shaping ethically aligned technologies. As AI diffuses into medicine, education, and finance, the question of embedding moral norms in design has become urgent. The materialization of morality is especially relevant here. Smart

medical devices, for example, can set rules, collect data, and provide behavioral feedback that encourages healthier conduct without continuous external supervision. Such design motivates patients to follow morally inflected health routines. This approach supports efficient and precise task performance while guiding behavior at a less visible level. It shows that technology contributes to behavioral norms and social responsibility, so that users begin to follow ethical standards in ordinary use.

Verbeek's philosophy is also salient in smart city development. Smart infrastructures do more than increase administrative efficiency. They influence behavior, values, and social interaction. Mediation plays a crucial role. Intelligent traffic systems that rely on scheduling, prediction, and real time feedback can optimize flows and also reshape travel habits, encouraging citizens to plan routes more responsibly. Social efficiency and a sense of responsibility improve as design steers everyday practice toward sustainable development. This regulation does not depend on coercion. Moral norms are woven into daily routines through design so that citizens willingly align with social expectations while enjoying convenience and comfort.

Digital education provides another field of application. With the rise of online platforms, teaching technologies deliver content and also modulate learning behavior through analytics and feedback. Recommendation functions tailor learning plans based on traces of student activity. This personalization raises efficiency and at the same time embeds normative expectations for study, encouraging self directed learning within appropriate behavioral standards and supporting both individual development and

social understanding. Through mediation and internalized norms, educational technology takes on a role in transmitting and strengthening ethical and social values.

Verbeek's ideas also inform approaches to data privacy and security. In a digital society, protection of personal information is a central concern. The materialization of morality reminds designers and firms that systems must satisfy functional requirements and carry social responsibility. Encryption, differential access, and privacy by design can be built into technical architectures so that user data are protected while ethical norms are honored. Ethical internalization at the level of design embeds public interest and individual rights in the technical substrate.

2.3.2 Critiques and Limitations

Despite its theoretical value and practical promise, Verbeek's philosophy faces critiques and limits when applied in real settings, especially under conditions of globalization and cultural plurality.

First, mediation has a double edge. Although Verbeek emphasizes the constructive role of technological modulation, mediation can raise ethical concerns. In some contexts it risks excessive intervention in freedom and moral autonomy and can overregulate everyday life. Smart surveillance may improve safety, yet reliance on it for management and control can infringe privacy, constrain free choice, and tighten control over conduct. The challenge is to balance social benefits from mediation with individual liberty when systems such as large scale analytics and AI decision tools are involved.

Don Ihde's postphenomenological perspective offers an important complement to this view. Ihde emphasizes the multiplicity and embodiment relations of technological mediation, arguing that humans, in their interactions with technology, form different levels of perceptual and existential relations rather than merely being passively regulated⁴⁹. In contrast, Verbeek's theory of technological mediation focuses more on how technology influences behavior, with less attention to how it shapes human perceptual structures and experiential worlds. Ihde's theory reminds us that the moral impact of technology is not limited to the normative level but also lies in how it transforms human experience itself. Therefore, if the differences in such embodied experiences are overlooked, ethical analyses of technological mediation will struggle to fully grasp the profound role of technology in human life.

Second, the materialization of morality is innovative in theory but difficult to implement in practice. How to embed norms effectively in complex products remains a demanding task. Although developers often acknowledge the importance of ethical internalization, design teams may neglect it or treat it superficially. Social media and e-commerce platforms provide examples. Even where data protection features exist, recommendation algorithms and targeted advertising may amplify certain normative pressures, leading to excessive steering of behavior and moral imbalance. Designers still struggle to find workable tradeoffs between ethical standards and technical or commercial goals.

49 Ihde, D. (1990). *Technology and the lifeworld: From garden to earth* (No. 560). Indiana University Press.

Third, questions arise about applicability in global and culturally diverse settings. Moral norms vary across societies. A single ethical design may fail to meet the needs of all groups. Data privacy standards differ across jurisdictions. Establishing design principles that satisfy widely shared ethical expectations under globalization remains a challenge. Verbeek's theory does not fully address how to respond to such cultural variation, which limits its reach in cross cultural contexts. The task of setting and enforcing broadly acceptable technological ethics becomes a central test for the framework.

Finally, although Verbeek assigns moral responsibilities to designers, practical guidance on how to fulfill them is often insufficient. In many organizations profit motives dominate, and ethical responsibilities may be sidelined. Realizing the promise of mediation and the materialization of morality depends on mechanisms that ensure designers take ethics seriously, including professional education, industry standards, and governance structures. Strengthening these supports is essential for translating Verbeek's philosophy into practice.

Chapter 3 Mediation: Reshaping Relations between Humans and Technology in the Acceptance of AIGC

3.1 Basic Theory of Technological Mediation

3.1.1 Verbeek's Concept of Technological Mediation

In contemporary philosophy of technology, Peter Paul Verbeek's concept of technological mediation provides a key perspective for understanding how technologies affect relations between humans and the world. Unlike classical instrumentalism or technological determinism, Verbeek emphasizes that technology should not be treated as a mere tool. It acts as an active mediator within complex relations between humans and the world. In Verbeek's framework, technology influences behavior at the functional level and also modulates perception, cognition, and social practice. It shapes the ways in which we interact with the world.

In existing scholarship the term "mediation" has at least three meanings: intermediation, arbitration, and regulation⁵⁰. First, "intermediation" often describes a mediating role that connects two sides and coordinates their relation. In postphenomenological research this sense does not fully match Verbeek's position because it suggests a static bridge and neglects interaction and dynamics. Second, "arbitration" refers to an intervening role that reconciles parties in conflict. Although relevant in some settings, it does not capture the symbiotic relation between humans and technologies. By contrast,

50 Miller, M. B. (2002). The Meaning of Mediation: Discussion of Varying Perspectives. *Journal of Cognitive Education & Psychology*, 3(1).

"regulation" is more apt for Verbeek's view. Technological mediation denotes guidance based on feedback in which systems adjust behavior through state sensitive responses and in this way shape the relation between humans and the world. Technology is not simply an extension or supplement to action. Through relations of co constitution it participates in forming social conduct, moral judgment, and a worldview.

Grounded in postphenomenology, Verbeek's theory is concerned not only with how technologies affect perception and behavior but also with how design gives rise to specific moral and social practices within cultural settings. He does not ask about the essence of technology so much as what technologies do. The principal role of technology lies in how it mediates and shapes the relations between humans and the world⁵¹. When put to use, technologies modulate behavior, cognition, affect, and social interaction through design. In doing so they shape social practices and moral action.

Compared with instrumentalism and determinism, Verbeek's concept highlights interaction and co shaping between technology and human behavior. Instrumentalism treats technologies as neutral means to ends. Determinism treats technology as a decisive force that molds society and culture. Verbeek holds that both reduce a complex relation to a simple scheme. Mediation is not an external impact on behavior. It is a process in which technologies, humans, and the world form one another. Technology as mediator is not opposed to human conduct or to culture. It is intertwined with them

51 Verbeek, P. P. (2015). COVER STORY beyond interaction: a short introduction to mediation theory. *interactions*, 22(3), 26-31.

in a relation of mutual dependence. Technology is a reflection of social behavior and at the same time a formative factor in conduct and moral practice.

Verbeek also stresses that mediation is never fixed. It always operates within specific contexts of use and within particular social and cultural environments⁵². The force and effects of mediation vary across cultures, histories, and social structures. They depend on material design and on background values and identities. In AIGC oriented interaction design, mediation is especially salient. Through feedback on generated content and through recommendation algorithms, such systems shape choices and creative activity and also modulate cognitive frames and moral judgment. Mediation is therefore context embedded rather than free standing.

A core feature of mediation is its reliance on feedback for self correction⁵³. Through ongoing interaction with users, technologies guide behavior and dynamically adjust to use patterns. In this way they influence social practices and moral choice at deeper levels. The effect is not confined to a single application. Cross domain feedback can produce wider social consequences. In interaction design, for example, interface choices and interaction logics can modulate affective experience, behavioral pathways, and ethical inclinations. By anticipating likely actions and embedding scripts, designers can lead practice toward socially responsible outcomes during use.

⁵² Verbeek, P. P. (2005). *What things do: Philosophical reflections on technology, agency, and design*. Penn State Press.

⁵³ Verbeek, P. P. (2024). *Moralizing technology: Understanding and designing the morality of things*. University of Chicago press.

Consider the recommendation system of Netflix. By analyzing viewing histories, ratings, and search traces, the platform builds personalized recommendations. Beyond matching interests and preferences, the system incorporates ethical considerations such as encouraging cultural diversity and attention to gender representation. It can recommend works from different countries and cultural backgrounds to invite engagement with diverse content and to avoid confining users to mainstream genres alone. It may also limit recommendations that are excessively violent, vulgar, or controversial, especially for younger audiences, and in this way guide choices toward healthier entertainment. Such design aims to improve experience and also to promote social responsibility and ethical values through interaction logic. At the same time, concerns arise about undue intervention in cultural circulation. If actors use these mechanisms to implant specific values, they may guide opinion or pursue cultural domination. The risks of polarization and social division therefore require careful attention and safeguards.

Verbeek's concept of technological mediation thus offers a new framework that moves beyond the limits of instrumentalism and determinism and clarifies the ethical functions of technology in contemporary society. In the ongoing development of AIGC and intelligent interaction, the perspective of mediation reminds us that technology is not only a means to satisfy functional demands. It is a powerful force that shapes social values, moral behavior, and cultural identity. This framework deepens research in the philosophy of technology and provides a firm basis for ethical reflection in artificial intelligence and interaction design.

3.1.2 Technological Mediation and the Reconstruction of Subjectivity

Verbeek's theory of technological mediation offers a new framework for understanding interaction between humans and technology and invites a reconsideration of subjectivity and freedom. Technology is not a purely external tool or a neutral medium. Within complex interactions it becomes a factor that shapes and modulates relations between humans and the world and among humans themselves. In this framework technology influences cognition and behavior and also reconstructs subjectivity. Under contemporary AI, relations between technology and subjectivity have undergone profound change.

With AI the discussion of mediation and the reconstruction of subjectivity enters a new stage. Earlier accounts often treated technology as a passive prop that shapes practice and experience through design. With the rapid advance of artificial intelligence, especially AIGC, automated recommendation, and decision support, systems acquire learning capacities and can substitute for human judgment. They are widely deployed in credit scoring, medical screening, and financial transactions. The apparent autonomy of such systems has increased. Technology no longer merely mirrors human action but begins to shape social structures actively.

This shift does not entail a return to strict technological determinism. Verbeek makes clear that technologies are not independent agents. They are products of design⁵⁴. Even when AIGC learns and adjusts, it does so within rules, goals, and data regimes set by humans. Training sets, objective functions, and constraints are designed by people, and these carry data biases and commercial logics. AIGC does not emerge from a vacuum. It embodies human intentions and social contexts.

The familiar binary between technology led and human led control cannot capture the present situation. Verbeek's account suggests a different view. We are entering a co leadership era. Humans and technologies are neither strictly opposed nor simply subordinated to one another. They form a complex co evolutionary system in which each shapes the other and together they guide social change. Technologies modulate conduct and structure through design and application. Humans shape technologies through rule setting, data curation, and ethical design.

This view resonates with broader philosophical work that moves beyond dualism. For Gilbert Simondon, individuals and technologies are not isolated. Through processes of technical individuation they continually bring each other into being. Interaction is not one way. It is co generative and symbiotic⁵⁵. Technology is not only a mediator of action. It is also a force that shapes subjectivity. Bruno Latour's actor network theory places humans and technologies on an analytic par. Both count as actants within

⁵⁴ Verbeek, P. P. (2015). COVER STORY beyond interaction: a short introduction to mediation theory. *interactions*, 22(3), 26-31.

⁵⁵ Simondon, G. (2005). *L'individuation à la lumière des notions de forme et d'information*. Éditions Jérôme Millon.

networks and act together in ways that generate social structures. From this angle technology and subjectivity jointly constitute the basic fabric of society.

In a Foucauldian genealogy of power, technology is not a single determining force. It functions together with discipline, discourse, and institutions to organize power. Technologies intertwine with norms, institutions, and cultural values and together shape moral outlooks, behaviors, and practices. AI therefore cannot be explained by determinism or simple subordination. It is part of a complex symbiosis that requires new philosophical categories to match contemporary realities.

In further uncovering the deep mechanisms underlying the reconstruction of subjectivity, Bernard Stiegler's philosophy of technics offers a crucial contribution. Stiegler proposes that "technology is the pharmakon of humanity", meaning it serves as both a remedy and a potential source of alienation. He argues that technology functions as the "external organ" of human memory and experience (tertiary retention)⁵⁶. Through the externalization of memory, humans both preserve experience and gradually lose active control over it. When AIGC systems become primary producers of knowledge and symbols, this "external memory" is reorganized by algorithms, causing human creativity and judgment to increasingly depend on technological logic, thereby transforming the very process through which subjectivity is formed.

⁵⁶ Stiegler, B. (1998). *Technics and time, 1: The fault of Epimetheus* (Vol. 1). Stanford University Press.

According to Stiegler, technological development carries the risk of proletarianization, in which human skill, judgment, and attention are outsourced to machines. While AIGC enhances efficiency, it may simultaneously weaken human capacities for learning and reflection, reducing individuals from creators to mere selectors. Human experience becomes platformized and algorithmically mediated, attention is fragmented and commodified, and the temporal rhythm of creation is redistributed by technology⁵⁷. This process reveals that technological mediation operates not only on the level of action but also within the deeper psychological and temporal structures that shape the formation of subjectivity.

In response to this trend of de-subjectivation, Stiegler proposes a politics of care, advocating for the redesign of technology as a space for cultivating judgment and collective learning⁵⁸. Within the context of AIGC, this means preserving educational friction and visible spaces of reflection within system design, enabling humans to regain agency in their interactions with technology. In other words, technology should not replace human thought but should encourage humans to relearn how to judge, choose, and create.

Unlike Verbeek's notion of technological mediation, which focuses primarily on the ethical shaping of action, Stiegler's perspective reveals how technology reshapes human attention and perceptual structures, providing a deeper psychological and cultural dimension to the reconstruction of subjectivity. The combination of these two

57 Stiegler, B. (2010). *Taking care of youth and the generations*. Stanford University Press.

58 Stiegler, B. (2015). *States of shock: Stupidity and knowledge in the 21st century*. John Wiley & Sons.

perspectives allows for a more comprehensive understanding of how technology in the age of AIGC functions as a mediating force that shapes the very conditions of human existence.

Verbeek's theory of technological mediation offers profound theoretical support for examining the ethical dimensions of contemporary AI technologies. AI is not merely a subordinate tool; it actively shapes and regulates human behavior through interaction, while humans, in turn, influence technology through design and ethical frameworks. As the relationship between technology and humanity continues to evolve, we have entered a new era in which both co-construct society. In this stage, technological mediation is not only an intervention in human behavior but also a process of co-evolution between technology and human subjectivity. Thus, the theory of technological mediation provides a powerful framework for understanding the ethical challenges and social transformations of the AI era, allowing us to examine the increasingly intricate relationships between humans, technology, and the world from the perspective of a co-agential epoch.

3.2 Ethical Responsibility in Technological Mediation

3.2.1 Technological Mediation and Moral Action

Within Verbeek's theory, technologies do not only affect relations between humans and the world. They also shape and modulate moral action. Mediation can influence moral intention and alter how individuals perceive situations and make ethical choices.

Through design, use, and feedback mechanisms, technologies modulate behavior and help form moral agency. Verbeek does not claim that artifacts possess moral agency by themselves. Rather, moral agency emerges in interaction between humans and technologies and guides conduct.

Verbeek identifies two core elements in the constitution of moral agency, namely intentionality and freedom⁵⁹. Intentionality has a double meaning in philosophy. In phenomenology it names the directedness of consciousness toward objects and phenomena. In postphenomenology it expands to the capacity to form intentions in context, that is, the ability to generate specific actions in particular situations.

Within mediation, intentionality is not confined to the free will of an isolated individual. It arises from complex human technology interaction. Consider prenatal ultrasound. Parents do not make moral decisions in isolation. Their judgments are mediated by the technology that presents the fetus visually. Ultrasound images alter perception and thereby influence decisions. Technology is not a simple tool. It interacts with moral judgment and shapes decision making. The decision is not determined by the device. It is co shaped by technology and human agents⁶⁰.

Freedom is the second core element. In a technologically mediated world freedom is not defined by the absence of influence but by the ability to choose and to act together

59 Verbeek, P. P. (2013). Some misunderstandings about the moral significance of technology. In *The moral status of technical artefacts* (pp. 75-88). Dordrecht: Springer Netherlands.

60 Verbeek, P. P. (2008). Cyborg intentionality: Rethinking the phenomenology of human-technology relations. *Phenomenology and the cognitive sciences*, 7(3), 387-395.

with technologies. People cannot entirely escape technological modulation. In modern societies almost all actions and decisions are mediated. Absolute freedom is therefore limited. Freedom should be understood as the capacity to make ethical choices under conditions of mediation. If conduct is fully governed by technological systems, it ceases to be free. Freedom consists in maintaining autonomy while engaging with technology and participating in its use and in ethical decision making.

This account changes how we understand technologies. They are not neutral tools. They are active mediators of relations and conditions for moral practice. Technologies help people form moral judgments within specific social contexts and choose among courses of action. Mediation alters perception and enables moral practice. Humans become co creators of a moral world together with technologies.

Risks remain. Mediation can also intensify inequality or entrench bias. Every design decision carries normative tendencies. Data skew, hidden assumptions, and commercial objectives can affect behavior and judgment. Verbeek's theory therefore calls on designers to anticipate ethical consequences and to build systems that meet ethical requirements.

Unlike Peter-Paul Verbeek, who explores how technology shapes moral behavior through technological mediation, Shannon Vallor approaches the issue from the perspective of technology and virtue, focusing on how humans can preserve and cultivate moral character within technological environments. In her influential work *Technology and the Virtues*, Vallor argues that in an era where artificial intelligence,

robotics, big data, and social media are reshaping human life, traditional moral rules and consequentialist ethical frameworks can no longer adequately guide behavior⁶¹. She proposes that humanity must cultivate a set of technomoral virtues within its symbiotic relationship with technology, ensuring moral growth and spiritual flourishing amid rapid technological transformation.

Drawing on Aristotelian virtue ethics and extending it to contemporary social and technological contexts, Vallor contends that technology is not merely an external condition for human action but an internal environment for moral formation. Moral character is not an abstract ideal but is continuously shaped, strengthened, or diminished through daily interactions with technologies, algorithms, and platform systems. Technology can thus function both as a medium for the cultivation of virtue and as a catalyst for moral decline. Vallor identifies eleven key technomoral virtues that sustain human happiness and moral life in modern society: honesty (respect for truth), self-control (mastery over desire), humility (awareness of one's ignorance), justice (commitment to fairness), courage (balance between fear and hope), empathy (compassion toward others), care (benevolent service), civility (creation of meaningful social life), flexibility (adaptability to change), perspective (holistic understanding of complex contexts), and magnanimity (moral leadership and nobility of spirit). These virtues are not fixed moral prescriptions but must be practiced, reflected upon, and renewed through lived experience within technological environments.

61 Vallor, S. (2016). *Technology and the virtues: A philosophical guide to a future worth wanting*. Oxford University Press.

Vallor emphasizes that modern technologies are transforming the very social conditions under which virtues are formed. In algorithmically mediated information environments, attention and judgment are fragmented by instant feedback mechanisms, weakening virtues such as self-control and humility. In AI-assisted decision systems, overreliance on algorithms may erode courage and practical wisdom, while the anonymity and emotional algorithms of digital social networks reshape empathy and care, rendering moral emotions fragmented and superficial. Therefore, the central task of technological ethics is not simply to prevent harm but to reconstruct a sociotechnical ecology that nurtures virtue through education, design, and institutional support.

From this perspective, Vallor's technomoral virtue ethics complements Verbeek's theory of technological mediation. While Verbeek emphasizes how technology regulates moral choice and guides behavior, Vallor focuses on how individuals, within technologically mediated contexts, can maintain and develop their moral selves through virtuous practice. The former reveals how technology shapes human action, while the latter offers a moral path for responding to that shaping. Together, they help us understand not only how technology influences humanity but also how humans can become better within and through technological engagement.

Within this theoretical framework, the ethical implications of AIGC and other intelligent generative technologies become particularly significant. Verbeek's theory explains how such systems guide and constrain user behavior through structural mediation, while Vallor's perspective highlights whether individuals can preserve

virtues such as honesty, self-control, and insight within such regulated environments. In this sense, technology's ethical impact extends beyond shaping external actions to influencing the inner cultivation of character and virtue. As highly interactive and adaptive systems, AIGC technologies have become key arenas for the practice of virtue in modern society. They can enhance rationality and creativity but may also reinforce bias and desire through algorithmic feedback, weakening self-reflection and moral sensitivity.

The point is acute in applications of AIGC. Consider the content recommendation system of TikTok. The platform analyzes viewing history, likes, comments, and shares to generate personalized feeds. Beyond matching interests, filtering, ranking, and pushing content influences interests, behavior, and even moral choices. By optimizing for engagement, the system tends to promote videos that elicit strong affect. This can lead to overexposure of certain types of content. In some cases recommendations privilege sensational, extreme, or highly controversial material, which can shift value judgments. Although the platform describes recommendations as interest based, the metric of engagement implicitly modulates what users find interesting. The result affects entertainment and can also shape views about morality, social responsibility, and public affairs. When algorithms repeatedly amplify topics that contain gender bias, violence, or extreme political positions, user attitudes may be subtly guided.

This is a form of the filter bubble. Personalized feeds confine users within homogeneous information environments. Exposure narrows. Algorithmic logics pre

structure attention, preferences, and social attitudes. Platforms increase retention through recommendation and shape values through the curation of attention. For this reason designers of AIGC systems must consider how mediation influences moral behavior and ensure that modulation aligns with ethical norms that serve society.

3.2.2 Responsibility and Power: The Ethical Dimensions of Technological Mediation

In Verbeek's account, technological mediation shapes human conduct and moral intention and also plays a decisive role in the distribution of responsibility and power. Mediation does not stop at the level of individual behavior. At broader social scales it redefines the concepts of responsibility and power. With the rapid development of AIGC and automation, technologies no longer appear solely as instruments. In some domains they operate with a degree of autonomy, which makes the attribution of responsibility and the allocation of power more complex.

This study employs Verbeek's notion of mediation profoundly affects the attribution of moral responsibility⁶². With the spread of automation and intelligent systems, technologies begin to participate in decision processes rather than merely assisting human action. The case of autonomous vehicles illustrates the point. When a driving system makes a decision, who bears responsibility The manufacturer, the software

62 Verbeek, P. P., & Slob, A. (2006). Analyzing the relations between technologies and user behavior: Towards a Conceptual Framework. In *User Behavior and Technology Development: Shaping Sustainable Relations Between Consumers and Technol* (pp. 385-399). Dordrecht: Springer Netherlands.

developer, or the driver. The ambiguity of responsibility reflects how mediation shifts the boundaries of accountability. For instance, BYD publicly pledged that any damages caused during the use of its automated parking system would be borne by the company itself. Such a commitment reveals how responsibility is no longer assigned solely to the human user but is redistributed among manufacturers, software developers, and technological systems. This blurring of accountability boundaries highlights how mediation reshapes traditional notions of moral responsibility.

Mediation also involves norm formation and the redistribution of power. Technology is not an isolated tool. It is deeply interwoven with behavior and social structures. In this process it exercises a form of implicit power by standardizing behavior through design and implementation. Recommendation algorithms on social media, for example, shape interests, opinions, and even consumption choices. Users may not recognize this exercise of power, yet their habits and value orientations are significantly altered.

Verbeek further maintains that technology sometimes becomes part of the structure of society itself. In the information age, technologies influence decision making, social interaction, and cultural formation. Under intelligent mediation, the scope of freedom and action can be constrained without notice. Freedom should not be understood as freedom from influence. It should be seen as a capacity for active participation. By modulating intentions and actions, technologies expand possibilities while tightening the coupling between humans and technical systems. Mediation therefore shapes modes

of action and at the same time modifies our understanding of freedom, responsibility, and power.

This perspective provides an ethical framework for rethinking mediation. Technologies are not neutral implements. They intervene in how responsibility is conceived, how power is exercised, and how freedom is understood. Faced with the ethical challenges posed by AIGC and automation, designers and developers must consider technology as an active mediator that shapes social order, moral conduct, and personal responsibility. Design decisions should therefore anticipate consequences for social structures, moral practices, and individual freedom.

3.3 Future Challenges for AI Mediation

3.3.1 Framework and Challenges of Adaptive Mediation

With the rapid growth of artificial intelligence, especially voice assistants and recommendation systems, adaptive mediation has become a central feature of application. Technologies do not merely assist behavior. Through learning and continuous optimization they calibrate relations among behavior, perception, and experience. Verbeek's thought offers a philosophical basis for this phenomenon. Technology is not only an instrument of action. It profoundly shapes interaction and cognition between humans and the world and among humans themselves.

Within Verbeek's framework, technology is a dynamic, co constitutive presence rather than a purely external artifact. Voice assistants exemplify this point. Through adaptive

learning they adjust to needs, linguistic habits, and living environments. They also modulate user behavior and refine interaction through feedback. In this way they change users' understanding and experience of technology. This is mediation in Verbeek's sense. Design must therefore attend not only to function but also to how adaptive mediation fosters deeper relations with users.

Significant challenges arise in practice. The first concerns individual differences and the realization of genuine personalization. Users differ in background, needs, technological readiness, and settings. Older adults may be uncomfortable with complex interfaces and rapid responses, whereas younger users may expect richer features and personalization.

Current practice often remains superficial. So called senior friendly phones may enlarge fonts and increase volume yet leave information hierarchy and navigation complexity largely intact. Interfaces still require traversing multilayer menus. Interaction logics often presuppose the cognitive tempo of younger users and neglect limits in speed, attention, and memory. Feedback is frequently insufficient. Clear prompts and error recovery paths are missing, which amplifies frustration. Moreover, older adults are rarely involved in co design. Products are built on designers' assumptions rather than on situated needs. Such symbolic adjustments do not reach the level of deep interaction logic and therefore fail to meet real requirements. This counterexample highlights a core difficulty of mediation. Designers must move beyond surface level modifications

and include user diversity and subjectivity at the outset in order to achieve inclusive, personalized mediation.

A second challenge concerns trust and transparency. Despite advances in speech recognition and natural language processing, many users, especially older adults and those unfamiliar with technology, experience the black box effect. Similar concerns arise in AIGC products and autonomous driving. Verbeek's account implies that mediation is constitutive of relations. Effective adaptive mediation therefore depends on transparency and explainability that help users understand decision processes and build trust. Without trust users will not sustain engagement, which weakens the long term effects of mediation.

A third challenge concerns cross cultural applicability. In Verbeek's view, mediation is intertwined with social contexts, cultural values, and norms. Design must consider local attitudes toward technology, privacy, and personalization. Some cultures place a premium on data protection, while others prioritize convenience and efficiency. Adaptive mediation should be conceived within a framework that balances localization with global reach so that voice assistants and related systems can interact effectively and appropriately across settings.

3.3.2 Cross Cultural Technological Mediation

As artificial intelligence (AI) technologies continue to spread globally, cross-cultural technological mediation has become an increasingly significant area of research. Across different cultural and social contexts, the acceptance, use, and impact of AIGC technologies often display striking variations. These differences are not limited to patterns of use but also extend to the complex interactions between technology, society, culture, and moral values. Peter-Paul Verbeek's concepts of technological mediation and moral materialization provide a profound philosophical perspective for understanding cross-cultural mediation, revealing how technology shapes human behavior, experience, and social structures within diverse cultural environments. At the same time, Yuk Hui's theory of cosmotechnics adds an important cultural-philosophical dimension to this discussion. Hui argues that technology is not the product of a single rational system but is deeply embedded in the cosmology, ethics, and ontology of each culture; hence, every civilization should have its own distinct technological cosmos⁶³.

Within the framework of cross-cultural technological mediation, technology is not a passive instrument but an active force that shapes relationships between humans and the world, between humans and technology, and among humans themselves. Verbeek's theory emphasizes that technology is never neutral-it always embodies the intentions of its designers, the imprints of culture, and the demands of society. Therefore, in cross-cultural contexts, the design and implementation of AI technologies are not merely technical matters but also processes of responding to and mediating different cultural norms, moral values, and user expectations. Hui further suggests that this mediation

63 Hui, Y. (2019). The question concerning technology in China: An essay in cosmotechnics (Vol. 3). mit Press.

occurs not only at the level of functionality or use but also within the deeper technological worldviews that underlie cultures. Western modernity has tended to view technology as a means of mastering and controlling nature, while Eastern philosophies often regard it as a process of harmony and co-evolution with nature. Consequently, the goal of cross-cultural technological mediation is not to impose uniformity across cultures but to enable diverse technological cosmologies to engage in dialogue and co-create differentiated ethical and value systems.

One of the key challenges in cross-cultural technological mediation lies in understanding and adapting to the social norms and value systems of different cultures. The acceptance and usage of technology are deeply shaped by historical, moral, and cultural traditions. For example, Western cultures, with their emphasis on individualism and autonomy, contrast sharply with Eastern cultures that prioritize collectivism and familial responsibility. As a result, the same technology may acquire entirely different meanings and functions across cultural contexts. In this light, the design of AI voice assistants and similar systems must take cultural factors seriously, ensuring that technologies not only meet user needs but also resonate with local social and moral values. From the perspective of Hui's cosmotechnics, these cultural differences are not superficial issues of adaptation but reflect fundamentally distinct ways of understanding "technology" itself. Each culture's technological practice expresses its unique relationship with the world and its ethical order. Thus, cross-cultural technological mediation must respect this diversity rather than treat Western technological rationality as a universal norm.

Verbeek's idea of moral materialization provides an important insight here: technology is not merely a functional tool but becomes materialized and integrated into cultural practice in different environments. Through interaction with users, technology participates in shaping human behavior and social organization. In cross-cultural contexts, designers must understand how technologies are "materialized" differently across cultures and how their functions and meanings shift in the process. For instance, Chinese culture, long influenced by pragmatism and realism, emphasizes the social utility and practical value of technology. The ancient Four Great Inventions of China, such as papermaking and the compass, were aimed primarily at improving production and daily life. Today, this orientation persists in applications of AI within smart factories, automated logistics hubs, and intelligent sorting systems, where technology is deployed to enhance productivity and social stability. In contrast, Western traditions, shaped by idealism and critical inquiry, often frame technology as a means of exploration and innovation, emphasizing creativity and experimentation. AI technologies in Western contexts thus find prominence in artistic creation, language generation, and human-machine interaction, highlighting individuality, expressive freedom, and critical thought. In China, technology is more often materialized as an instrument of collective productivity and social responsibility, while in the West, it tends to be materialized as an extension of individual creativity and autonomy. This contrast affirms Hui's assertion that technology cannot be understood as a neutral or universal rational mechanism but as a concrete manifestation of each culture's worldview.

Cross-cultural technological mediation also involves responding to diverse ethical demands within different cultural settings. Issues such as privacy, data security, and moral responsibility play varying roles in different societies. Verbeek's mediation theory emphasizes that technology must align ethically as well as behaviorally with social norms. In some cultures, personal data protection is considered the highest ethical priority, while in others, social welfare or collective responsibility may take precedence. Thus, technological design must not only regulate behavior but also reflect on and adapt to the ethical and social values of different cultures. Hui points out that the roots of these ethical differences lie in distinct understandings of the relationship between technology, nature, and humanity. Western ethics often rest on a subject-object dualism, whereas Eastern traditions approach technology and nature within a holistic "unity of heaven and humanity" framework. This difference requires cross-cultural design to move beyond universal ethical norms and seek modes of mediation that accommodate multiple cosmologies.

The challenge of cross-cultural technological mediation extends beyond individual behavior to encompass the broader interaction between technology, society, and culture. Verbeek argues that technology mediates not only human-technology relations but also the interplay between technology and other elements of the social environment⁶⁴. In different societies, this mediation can have profound implications for social structure, power relations, education, and health. For instance, the application of AI in education

64 Verbeek, P. P. (2013). Technology design as experimental ethics. In *Ethics on the laboratory floor* (pp. 79-96). London: Palgrave Macmillan UK.

may focus on improving individual learning efficiency in Western contexts, whereas in East Asian societies it may emphasize promoting collective learning and ensuring educational equity. Thus, cross-cultural design requires moving beyond a single cultural lens to consider how technology can drive social transformation and advance public welfare across diverse contexts.

Finally, cross-cultural technological mediation calls for a careful balance between global universality and local specificity. As globalization accelerates, technologies increasingly circulate across national and cultural boundaries. The key challenge for designers is how to preserve the universality of technology while ensuring sensitivity to local social and cultural needs. Verbeek's idea of moral materialization reminds us that technological design and mediation are not simply responses to user demands—they are deeply intertwined with social environments, cultural values, and ethical norms. When combined with Hui's cosmotechnics, this balance emerges not from enforcing a single global standard but from the ethical co-creation that arises through dialogue among diverse technological cultures. Only by acknowledging the plurality of technological cultures and the cosmological diversity of human societies can cross-cultural technological mediation achieve both ethical inclusiveness and philosophical universality.

Chapter 4 Materialization: Ethical Practice in the Acceptance of AI Technology

4.1 Basic Theory and Philosophical Background of Materialization

4.1.1 Verbeek's Concept of the Materialization of Morality

Within Peter Paul Verbeek's philosophical lineage, the materialization of morality is not a stray terminological novelty. It follows necessarily from his postphenomenological account of technological mediation. Once technology is understood as a relational presence that continually mediates human perception and action, ethics can no longer be treated only as an external discourse that judges practice from the outside. Ethical order can be embodied, implemented, and guided through the structures and functions of things. Morality is not exhausted by articulable rules. It can be embedded as a material answer within technical artifacts and thus, in concrete situations of use, exert a non linguistic and pre reflective guidance on attention, choice, and conduct⁶⁵. This starting point shifts ethics from pure normativity or meta level commentary into the internal dynamics of the human-technology-world triad. The guiding question becomes how moral life is co constituted through technology. As artifacts enter the lifeworld, they operate through scripts, interfaces, defaults, thresholds, sensing, and feedback to adjust what is visible, what is amplified, and what is suppressed. In this way they exert fine grained and ongoing influence on what I can do, what I am inclined to do, and how I ought to do it⁶⁶. In this sense materialization of

65 Verbeek, P. P. (2005). *What things do: Philosophical reflections on technology, agency, and design*. Penn State Press.

66 Verbeek, P. P., & Slob, A. (2006). *User behavior and technology development*. Dordrecht: Springer.

morality de abstracts and de verbalizes ethical concepts and de centers subject focused accounts of moral genesis. Ethics is not first an inner act of sovereign will. It comes to be and takes effect within the human-technology composite formed in practice.

For precisely this reason Verbeek resists two classic positions. He rejects moral instrumentalism, which treats technology as a value neutral means and confines ethics to external judgments about adoption and use. He also resists crude technological determinism, which attributes ethical outcomes unilaterally to the autonomous force of technology. Against the first, materialization shows that artifacts are never empty vessels. Design and materiality already store and transmit value orientations such as safety, prudence, temperance, accessibility, and non discrimination. Ethics is not an ex post label. It is an operative mechanism. Against the second, materialization does not elevate technology into a fully fledged moral subject. Verbeek maintains a relational ontology in which agency, intentionality, and responsibility are jointly apportioned and reconfigured in concrete human-technology interactions⁶⁷. What he advances is not the thesis that technology is a complete moral actor but the claim that technology participates in the genesis of moral agency. Through mediating intentional structures, inviting or inhibiting action paths, threshold settings, feedback intensities, and configurations of access, artifacts help constitute specific orders of practice and thus the conditions of moral choice. This participation remains partial, situated, and co constituted rather than substitutive or essentialist.

67 Verbeek, P. P. (2024). *Moralizing technology: Understanding and designing the morality of things*. University of Chicago press

To grasp the precise target of materialization, it is helpful to distinguish two parallel formulations in Verbeek's usage: materializing morality and moralizing technology. The former stresses the dimension of the thing. It considers how abstract values become executable constraints and enablings within structures, interfaces, and workflows. Examples include interaction thresholds, defaults, prompts, and constraints that "invite" restraint and "discourage" recklessness. The latter names a methodological turn in ethics. It calls for embedding ethical reflection throughout research, development, and deployment through design assessment, accompaniment in context, and multi stakeholder dialogue so that technological trajectories proceed along responsible paths. The two are mutually supporting. Without procedural embedding, materialization risks remaining episodic. Without material carriers, moralization risks remaining at the level of declarative slogans. Verbeek therefore emphasizes an internal route for ethics. Ethics does not only speak in the key of "ought" from the outside. It works from within as "can" and "may," translating values into structures and behavioral scripts so that technology generates ethical guidance at the point of use⁶⁸.

Verbeek's materialization should not be conflated with reification in the Western Marxist sense. Reification names the freezing and alienation of human relations into relations among things under commodity logic and domination, and it privileges critique and unveiling. Verbeek's materialization is a methodological strategy of positive shaping. It gives ethical ideas an embodied, operable form inside technical artifacts so that practice can be guided at the level of conduct and ordering. The aim is

68 Higgs, E., Light, A., & Strong, D. (Eds.). (2000). *Technology and the good life?*. University of Chicago Press.

not to unmask the rule of things but to make things collaborative carriers of practical ethics once the fact of human-technology co constitution is acknowledged. When ethics runs through material structures, pre reflective individual behavior and collective action patterns can be gently redirected toward more appropriate forms without overt coercion⁶⁹. This also explains Verbeek's emphasis on multi stability and the designer fallacy. The same technology can stabilize into different patterns across contexts. A single moral script Verbeek's philosophy can be creatively repurposed or strategically bypassed. Materialization is therefore not a one off embedding. It is accompanying, situated, and iterative. Design contexts and use contexts must be connected through procedural dialogue and assessment so that the ethical orientation of artifacts is continuously calibrated and fitted to the world of practice(Fig. 7).

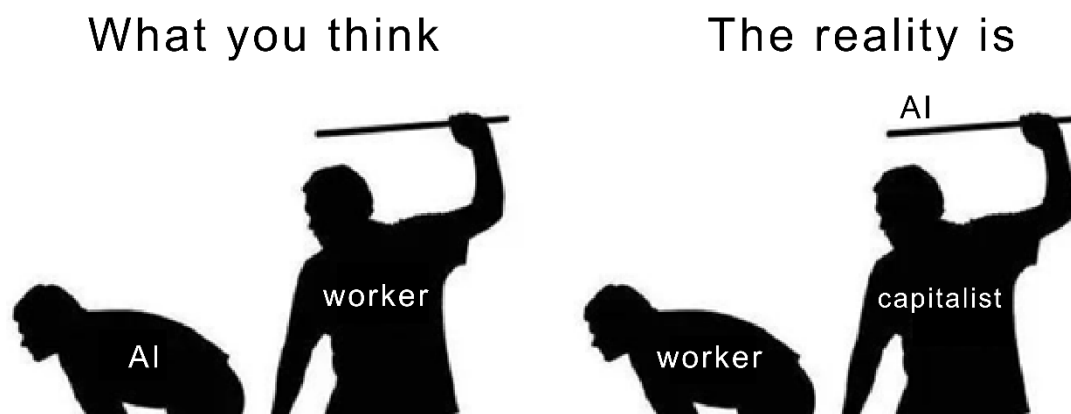


Fig. 7. This meme is widely known on the Chinese internet, and in some respects, it vividly reflects the idea that the essence of human-technology tensions is, in fact, rooted in broader social and class contradictions.

69 Tromp, N., & Hekkert, P. (2014). Social Implication Design (SID)-A design method to exploit the unique value of the artefact to counteract social problems.

When AI is hailed as a new engine of productivity, what it brings is not confined to leaps in efficiency and innovation. It also reorganizes labor relations and social structures. History offers precedents. The steam engine and the spinning jenny propelled the Industrial Revolution while displacing large numbers of workers and intensifying labor-capital conflict. In this historical horizon Marx introduced the notion of 'Verdinglichung' in his critique of political economy. Under capitalist relations of production, technology is never a value-neutral tool. It is disciplined by the logic of capital accumulation and converts social relations among persons into relations among things.

In Marx's analysis capital pursues surplus value without limit. The introduction of new technology is mobilized to raise labor productivity and compress labor costs, thereby securing competitive advantage. In the process workers lose control over the means of production and command over the product of their labor. Labor is converted into a force for capital's self-expansion, which in turn intensifies pressure on labor. This is Marx's alienation of labor. Workers are deprived of subjectivity and reduced to appendages of accumulation.

In the contemporary setting of AI the same logic appears in new forms. AI raises operational efficiency in finance, logistics, and manufacturing, yet the actors who command capital and platforms capture higher profits by substituting technology for labor. Workers confront job loss, skill devaluation, and weakened bargaining power. The ensuing social tensions do not arise only from a direct human-technology clash.

They reproduce labor-capital antagonisms under the rule of capital. Within the legitimating narrative of the market, AI is cast as an instrument of inevitable productivity growth, while in practice it often serves the expansion of capital rather than automatically delivering social justice.

Ethical reflection on AI should therefore move beyond the questions of neutrality and proper use. It must address the basic issues Marx disclosed. Who controls technology and the means of production. Who appropriates the surplus value that results. Who is systematically excluded from the dividends of technological change. Placing Verbeek's materialization of morality beside Marx's reification is illuminating. Verbeek stresses that ethical values should be embedded and operationalized in structures, scripts, and interactions. Marx warns that if the logic of capital is ignored, technology can become a conduit that sustains inequality and deepens social conflict. Taken together, these perspectives help reveal the social consequences of AI while guiding design and institutional arrangements that embed fairness and responsibility so that technology can serve human emancipation rather than capital accumulation.

Materialization of morality also implies a restructuring of moral subjectivity. Humanist ethics traditionally locates freedom, intention, and responsibility entirely within an autonomous subject and relegates technology to a neutral, interchangeable medium. Drawing on postphenomenological revisions of intentionality and Foucault's account of relational freedom, Verbeek argues for reconstructing the subject within mediation. Freedom is not a negative state of absence of constraint. It is a positive capacity to form

appropriate relations with environment and technology. Intentionality is not only an inner human state. It is shaped within the composite of human and technology through technologically directed orientation. Responsibility is no longer borne by an isolated subject alone. It must be distributed among designers, users, institutions, and artifacts. The result is a hybrid subject that comprises human reflection and judgment together with technologically shaped orientations to action through structures, thresholds, and feedback. In this sense putting morality in things does not threaten freedom. It conditions and supports it. Technical guidance and constraint enable individuals to pursue the good in complex settings with greater feasibility and sustainability. Through ethical design of artifacts, society can translate value orders into everyday practices that are perceptible, followable, and maintainable⁷⁰.

In sum, Verbeek's notion of materializing morality advances theory on three levels.

First, at the ontological level, technology is established as a mediator of the human-world relation rather than an external tool. This provides the structural premise for embedding, embodying, and practicing ethics.

Second, at the methodological level, values are translated into structures and scripts, which shifts the focus from evaluative ethics to guidance oriented ethics and enables ethical involvement across the full lifecycle of technology.

70 Higgs, E., Light, A., & Strong, D. (Eds.). (2000). *Technology and the good life?*. University of Chicago Press.

Third, at the level of subjectivity, the concept of a human-technology hybrid redistributes freedom, intentionality, and responsibility and gives philosophical footing, engineering feasibility, and social legibility to the proposition of doing good through things. On this integrated basis, subsequent analyses of ethical embedding and mediation in specific domains such as health care, education, urban mobility, and AIGC acquire a robust conceptual foundation and practicable pathway.

4.1.2 The Ethical Materialization of AIGC Technology

As Artificial Intelligence Generated Content diffuses across media, art, education, and commerce, its operations in content creation, data processing, and human interaction increasingly exhibit the features of materializing morality. Verbeek's account offers a philosophical lens for this process. By embedding ethical ideas in the structures and functions of AIGC systems, we can understand how technology shapes moral conduct and how artifacts guide and normalize moral decision making.

Ethical materialization here is a form of mediation. Morality is not a purely abstract value system. Through design it enters user experience, decision processes, and social effects. AIGC is a highly automated generator. Algorithmic and data driven models produce task-conforming outputs at speed. Yet outputs are not simply driven by user intent. They are conditioned by model architecture, training data, and parameterization.

Design therefore concerns not only performance. It directly concerns the guidance of norms and social values.

First, materialization appears in the moral guidance of generated content. AIGC produces text, images, and video for journalism, advertising, and social media. Internal preferences, output algorithms, and data handling shape both form and direction. In news automation, for instance, model biases in training data can privilege certain keywords or frames. Output reflects not only capability but also embedded value orientations. AIGC is thus more than a content machine. It acts as a moral mediator by influencing public perception and judgment through modes of generation. Verbeek's perspective clarifies how design materializes moral stances that structure behavior and interaction.

Second, materialization appears in the modulation of user behavior. The relation between users and AIGC is not a simple instrument-user dyad. It is a complex interaction. As systems learn from and adapt to user signals, they optimize personalization and precision, which in turn shape behavior. Recommendation engines on social platforms tailor streams that simplify choice, while filters and ranking influence opinion formation and habits. Moral guidance here does not operate through external commands. It works through design and operation that internalize values and provide nonlinguistic cues for conduct.

Third, materialization extends to the shaping of social values and cultural norms. As AIGC scales globally, its outputs affect individual decisions and, at larger scales,

collective value formation. In advertising, for example, AIGC alters consumer behavior and reframes the moral responsibilities of communication. If generative systems reproduce implicit bias, they can reinforce stereotypes or intensify consumerist orientations. Verbeek's account reminds us that the moral reach of technical materiality expands through cultural feedback. Technology is not neutral. By shaping public cognition, behavior, and value choice, it bears responsibility for the moral order of society.

4.2 The Impact of Materializing Morality on the Acceptance of AIGC

4.2.1 Ethical Internalization in AIGC Design

Ethical internalization is central to the design of AIGC. It concerns functionality and the incorporation of moral judgment and social value into construction and use. Internalization means that technology is designed and applied with explicit regard for responsibility and moral practice so that convenience is conjoined with ethical outcomes. This is acute in fields such as health care, where efficiency and accuracy intersect with dignity, privacy, and fairness.

Consider palliative care. AIGC is deployed to generate personalized comforting scripts, prompts for patient communication, and guidance for family members. These tools can provide support under resource constraints, yet they raise demanding ethical questions. Patient dignity and the authenticity of emotional care are at stake. If patients recognize

that part of the language that accompanies them is algorithmically generated, will their experience of peace be diminished. How can generation avoid reducing persons to data objects and instead reflect singular emotional and cultural needs. How should families' rights to information and participation be respected when scripts may carry value orientations that quietly shape choices. Designers must therefore introduce ethical constraints into model training and script generation, safeguard respectful language, avoid overly technicized consolation, and embed multidisciplinary review so that human care is not displaced. Only under such conditions can ethical internalization be realized in this highly sensitive setting.

Design for older adults presents further requirements. Many older users face barriers, including unfamiliarity and privacy concerns. Ethical internalization calls for more than service delivery. Systems must generate a sense of safety and respect and enable genuine comprehension. Interfaces should be legible, language simplified without condescension, and procedures transparent to reduce fear and resistance. In such contexts technology becomes part of the constitution of moral action. It guides decisions and shapes health behavior.

Privacy is equally fundamental. AIGC relies on large volumes of sensitive data to deliver personalization. Ethical design must embed privacy protection throughout collection, storage, and processing, with strict controls on authorization and use under legal and moral frameworks. Verbeek's account suggests that technology should not be

treated as a neutral instrument. By internalizing norms, it can participate in moral practice and help build a fair and transparent clinical environment.

Trust then grows through transparency and explainability as well as performance. When patients understand how the system reasons from their data and perceive that privacy is protected, acceptance increases. This is pivotal for widespread and effective application.

In short, ethical internalization is not an add on. It belongs at the core of AIGC design. It makes technology a participant in moral judgment and social responsibility rather than a cold mechanism. Designers should recognize that AIGC delivers more than efficiency. It directs moral behavior and social ethics. Only through thorough internalization of ethics in design can AIGC become a tool that promotes justice and human well being rather than a merely technical artifact.

4.2.2 Social Impacts of the Materialization of Morality

The social impacts of materializing morality extend beyond individual conduct to encompass social structures, cultural norms, and society's value regime as a whole. In Verbeek's account, technology is not an external tool. By *materializing* ethical ideas within technical design, it shapes moral action through the very interaction between users and artifacts⁷¹. The internalization of moral concepts into technology ultimately affects more than end users. It exerts wide social effects. With advancing technologies

71 Kroes, P., & Verbeek, P. P. (2013). Introduction: The moral status of technical artefacts. In *The moral status of technical artefacts* (pp. 1-9). Dordrecht: Springer Netherlands.

and the rise of AIGC, artifacts increasingly function across domains as material carriers of moral conduct. The resulting influence appears as guidance at the individual level and as pressure on broader ethical frameworks, power relations, and cultural values.

From the perspective of technological mediation, technology is tightly coupled with society. Design and use are never neutral. They embody designers' intentions, social contexts, and cultural factors. Materialization means that technology does more than help complete tasks. It acquires moral properties that influence decisions. Its design and operation reflect implicit social values and ethical standards. Materialization thus exceeds functional specification. Through artifacts it shapes social behavior and promotes social norms. In this way, moral ideas are conveyed and practiced via the material form of technological things and become part of social order and cultural identity.

In applications of AIGC, especially in health care and education, embedded norms and ethical prompts reorganize behavioral patterns at scale. In virtual hospital settings, AIGC can raise efficiency while embedding ethical decision procedures into clinical workflows. Triage, prioritization of critical care, and the balancing of resource allocation can be encoded and operationalized. Under such conditions AIGC does more than deliver a service. It internalizes sectoral ethical standards into design and advances their implementation through automated decisions. Materialization converts abstract values into operative guidelines that orient professionals when confronting complex dilemmas.

At the same time, materialization influences public values and behavioral norms more broadly. Verbeek emphasizes that moral effects are not imposed from outside. They are gradually incorporated through design and use. As AIGC systems optimize and learn, they not only meet individual needs but also self-adjust to habits and social contexts. Through this material form, technology can help to generalize commitments to fairness, transparency, and privacy.

The effects are not uniformly positive. As AIGC spreads, the delegation of moral practice to technology can produce adverse social consequences. One danger is an increasing social dependence on technical judgment that weakens individual responsibility. When AIGC participates in decisions in education or medicine, personal judgment can be displaced by the authority of "technical decisions." Unreflective reliance on systems erodes the space for autonomous moral deliberation and compromises society's capacity to constitute ethical norms on its own terms.

4.3 Critique and Philosophical Reflection on Materialization

4.3.1 Conflict Between Materialization and Subjectivity

Verbeek holds that technology functions as a mediator in moral conduct and decision making. This provokes a deep question about conflicts with subjectivity. If technology becomes a shaper and regulator of moral behavior, what happens to autonomy and free will.

Subjectivity denotes the capacity for self-determination and independent choice in moral, social, and practical domains. Classical ethics treats it as the exercise of freedom guided by rational judgment and moral standards. With the intervention of artificial intelligence and data-driven systems, this picture is complicated. Technological mediation is not neutral. Through design and functionality it affects behavior and decisions. When smart algorithms and recommender systems quietly steer users, freedom of choice is constrained. This study employs Verbeek's notion of mediation embeds values in artifacts so that behavior and judgment are guided without explicit instruction. Subjectivity becomes relational and situated rather than a purely internal resource.

Technology is therefore not merely an external controller. It co-constitutes new moral practices and social patterns with human agents⁷². Design can shape attention and preference by imperceptible means. For example, platform algorithms direct users' focus and interests. What appears as a convenience of interface is also a moral shaping of conduct.

Yet the influence of materialization is not unidirectional. Humans do not simply submit to technology. Users appropriate, reinterpret, and sometimes resist the scripts of design. The same artifact stabilizes differently across contexts. This plurality reveals tensions within subjectivity under materialization. Consider the smartphone. Intended to raise efficiency, it has become an object of dependence. Patterns of sociality, entertainment,

72 Kroes, P., & Verbeek, P. P. (2013). Introduction: The moral status of technical artefacts. In *The moral status of technical artefacts* (pp. 1-9). Dordrecht: Springer Netherlands.

and micro-decision are reorganized beyond original design premises. Creative use shows diversity and complexity in practice and exposes the friction between technical scripts and lived agency.

The conflict is not limited to overt constraint. It concerns subtle restructuring of roles and action patterns. As algorithmic curation personalizes content, choices seem free while attention and networks are tacitly normalized. Such influence emerges as habit and reliance rather than coercion. Subjectivity is shaped and directed rather than expressed solely through autonomous will.

Verbeek does not reduce technology to a unilateral force of control. He frames the relation as interactive and co-constitutive. Even so, mediation can erode autonomy when users lack sufficient understanding of operational mechanisms and ethical implications. Critical reflection is required on how design delimits the space of free choice and how moral judgment can be balanced with guidance in systems that materialize values. The ethical task is to secure subjectivity within design that recognizes diverse needs, cultural variety, and social environments so that mediation supports rather than undermines autonomy.

4.3.2 Power Relations in Materialization

Materialization reshapes power. Technology carries designers' intentions, social values, and cultural biases. These elements enter construction and application and affect

freedom and decision making⁷³. Moral or functional embedding in things operates at a deeper level as a reconfiguration of social power.

One salient feature is configuration power held by designers and platforms. Through interfaces, feature sets, and algorithmic logic, they specify what users can and cannot do and how actions unfold. In AIGC, model outputs depend on training corpora whose sourcing and filtering are controlled by developers. Users cannot inspect value orientations or alter construction logics. Algorithmic opacity can magnify bias and reproduce inequality. Knowledge boundaries and value frames are set upstream. Power concentrates in technical development and capital platforms.

From Michel Foucault's genealogical perspective on power, the "power of technological configuration" represents a form of micro-power that operates not through repression but through the productive shaping of subjectivity and knowledge. Foucault pointed out that modern power spreads through networks of technology and institutions, compelling individuals to participate actively in their own self-governance within processes of normalization⁷⁴. In technological systems such as AIGC, this mechanism becomes especially evident: algorithms, under the guise of "personalized recommendation," effectively redefine what counts as reasonable interests and mainstream values. Users are guided, monitored, and incorporated into predictable systems of behavior, even as they appear to make free choices. Verbeek's notion of technological mediation can thus be seen as the moral manifestation of this

73 Verbeek, P. P., & Tijink, D. (2020). Guidance ethics approach: An ethical dialogue about technology with perspective on actions.

74 Deleuze, G., & Foucault, M. (1977). Intellectuals and power. *Language, counter-memory, practice*, 205-17.

technological governance-it operates through the design logics and everyday interfaces of technologies, subtly directing users toward particular ethical norms and value orientations without their explicit awareness.

Within this context, the power relations embodied in technological materialization are reflected in how technology invisibly manipulates or adjusts individual behavior. As technologies grow increasingly complex and ubiquitous, human understanding and use of them become both dependent and constrained. For instance, social media platforms employ recommendation algorithms that optimize content based on users' past behavior, shaping their thoughts, interests, and social interactions. This influence is not enforced externally but achieved through the technological regulation of information flows. Users do not freely choose what they see; rather, their information access is structured and confined by the parameters of algorithmic design. The result is the emergence of so-called "information cocoons," in which user behavior is invisibly governed by technological systems. Foucault described this form of covert power as disciplinary power, characterized by the internalization of obedience and the automation of self-regulation. In AIGC systems, disciplinary power operates through algorithms that create and refine "user profiles," using feedback loops to continuously track, quantify, and reshape user behavior.

Second, the power relations within technological materialization also involve processes of dehumanization. From Verbeek's perspective, technology is not merely an extension

of human behavior but a force that can regulate, reshape, and at times replace human actions and decisions. In this sense, technology ceases to be a neutral tool and becomes an active agent shaping social norms and behavioral standards. In domains such as healthcare, finance, and education, an increasing number of decisions are now made by automated systems and artificial intelligence. These systems make judgments through programmed rules and data analysis-such as credit-scoring algorithms, AI-based diagnostic tools, or automated recommendation systems-without direct human moral deliberation. In this process, human freedom and decision-making are partially transferred to technical systems, which act as agents of behavior. This dehumanization strengthens technological control over social and individual conduct, while moral responsibility-traditionally borne by humans-becomes increasingly displaced onto machines. As Foucault observed in *Discipline and Punish*, modern power operates not through violence but through apparatuses (*dispositifs*)-networks in which technology, knowledge, and institutions intersect. AIGC represents the latest form of this apparatus: under the banner of efficiency and intelligence, it replaces judgment with automation, making power more invisible and irreversible through dehumanized operations.

Furthermore, the power dynamics of technological materialization often amplify existing inequalities and power asymmetries. In Verbeek's framework, technology is never neutral; its design and application inevitably reflect the perspectives of designers, the structures of society, and the interests of specific cultural or economic groups. Many technologies are created under the influence of particular stakeholders, and their

functions often align with those stakeholders' goals. A clear example can be found in Amazon's recommendation system⁷⁵. By collecting user data-browsing history, purchase records, and search queries-Amazon's algorithms continuously optimize advertising and product recommendations to maximize profit. While users nominally consent to data policies, they rarely understand how their data are used or the complex logic of algorithmic targeting. Although they appear free to choose, their decisions are subtly guided by platform mechanisms. For instance, a user browsing a single product may later receive a series of related advertisements, nudging them toward purchase. This seemingly autonomous behavior is in fact shaped by the platform's algorithmic mediation. Through big data and AI, the platform subtly controls user choice and reinforces its dominance over consumer behavior, thereby deepening the structural power imbalance between corporations and individuals.

In addition, the global diffusion of technology can widen digital divides between nations and social groups. Technological development is largely driven by industrialized countries, while marginalized regions and communities often lack the resources or infrastructure to participate equally. This unequal distribution of technology intensifies economic and social disparities and produces cultural misunderstandings and conflicts. Far from being neutral, the materialization of technology can reinforce existing hierarchies of power, consolidating the dominance of already privileged actors.

75 Verbeek, P. P. (2024). *Moralizing technology: Understanding and designing the morality of things*. University of Chicago press.

This inequality becomes particularly visible in the age of AIGC. Because of the enormous computational and financial resources required to train large-scale models, the leading systems are concentrated in the hands of a few global technology corporations. As a result, the selection of training data, sampling processes, and algorithmic architectures are unavoidably shaped by institutional biases and proprietary constraints. This human intervention has a dual nature. On one hand, regulatory mechanisms such as content moderation prevent the generation of harmful outputs- terrorism, hate speech, or explicit material- thereby serving legitimate social and ethical functions. On the other hand, when these same mechanisms are used to embed implicit commercial strategies, ideological cues, or cultural biases, their effects become subtle yet far-reaching. If the generative logic of AIGC systems systematically reproduces certain ideological or political orientations, the consequences extend beyond commercial manipulation, posing a deeper threat to the integrity of public discourse and the collective social imagination.

Ultimately, the power of technology's materialization operates not only in regulating individual behavior but also in reshaping social structures and distributions of power at a systemic level. Through the ways it mediates, structures, and sometimes replaces human agency, technology subtly reconfigures the balance of power within society. While Verbeek's theory of technological mediation and materialization highlights the productive and participatory dimensions of this process, it also invites critical attention

to the ethical and political risks embedded within it-specifically, how to prevent technological design from becoming an amplifier of inequality and how to ensure that the creation and application of technology genuinely promote justice and fairness for all.

Chapter 5 Responsibility Ethical Responsibility and Social Obligations in the Acceptance of AIGC Technologies

5.1 A Forward-Looking Perspective on Responsibility From Technological Mediation to Ethical Responsibility

5.1.1 Verbeek's Conception of Responsibility

In Verbeek's philosophy of technology, responsibility is not restricted to retrospective blame or reflection on outcomes that have already occurred. He advances a forward looking conception that reframes the relation between technology and moral responsibility at its roots⁷⁶. Unlike traditional ethical theories, Verbeek treats responsibility as proactive, anticipatory, and internalized. The question is not how to apportion blame after harms arise. The task is to consider possible ethical consequences at the moment of design and to forestall negative outcomes through design choices. Designers should assume moral responsibility from the outset, anticipate impacts, and use design to mediate technological effects so that use aligns with ethical norms.

Designers cannot foresee and preempt every downstream consequence. Responsibility therefore must extend across the full life cycle of a technology. Designers, developers, and users should maintain ongoing ethical reflection and adjustment during iteration, deployment, and feedback so that technological development remains aligned with public interest in a changing social context.

⁷⁶ Verbeek, P. P. (2009). Ambient intelligence and persuasive technology: The blurring boundaries between human and technology. *Nanoethics*, 3(3), 231-242.

Classical approaches such as deontology, consequentialism, and virtue ethics typically regard technology as neutral and locate responsibility in human agents alone. On this view artifacts are mere means. Verbeek rejects this assumption. Through design and use, technologies shape human behavior, decision making, and even social structures in deep ways. Artifacts are not innocent or value free. They participate in the formation of conduct and judgment. Responsibility therefore extends to technological artifacts understood as parts of moral practice. This does not displace human responsibility. It expands the domain of responsibility to the hybrid configuration of humans and artifacts.

Verbeek stresses that responsibility should be design oriented rather than confined to post hoc accountability. Traditional models look backward after problems emerge and seldom recognize the formative power of design or the obligations of designers⁷⁷. Verbeek proposes responsibility as an active practice within engineering. Ethical considerations should be integrated at the earliest stages. By anticipating and steering effects through design, engineers take responsibility in advance for social consequences.

This yields an expectation of anticipatory responsibility. Designers should foresee social impacts and moral ramifications and intervene during development. They must evaluate not only functional fit and market demand but also potential harms such as privacy breaches, bias, inequality, or environmental burdens.

⁷⁷ Verbeek, P. P. (2009). The moral relevance of technological artifacts. In *Evaluating New Technologies: Methodological Problems for the Ethical Assessment of Technology Developments*. (pp. 63-77). Dordrecht: Springer Netherlands.

Under this view responsibility is no longer a matter of tracing back from harm. It becomes a core element of the design process. Engineers assume obligations during conception and implementation so that systems do not generate unanticipated harms in use. The focus shifts from after the fact attribution to prevention and governance in advance.

Responsibility does not rest with designers alone. Users also bear obligations. They should cultivate technical literacy and ethical awareness, use systems appropriately, and acknowledge the social effects of their choices. In this way responsibility extends from designers to users and forms a shared ethical framework.

5.1.2 Integrating Responsibility into Technology Design

Verbeek's philosophy offers a framework that joins responsibility with design and moves beyond the limits of traditional attribution. Design is not only technical innovation. It is ethical decision making. A responsible design must consider social impact, moral consequence, and environmental fit.

Engineers should practice ethical foresight. At early stages they should anticipate possible impacts and adjust architectures and processes accordingly⁷⁸. For artificial intelligence this includes confronting bias, privacy risks, and data misuse through model objectives, dataset curation, and algorithmic constraints.

78 Verbeek, P. P. (2013). Technology design as experimental ethics. In *Ethics on the laboratory floor* (pp. 79-96). London: Palgrave Macmillan UK.

The idea of "prospective responsibility" resonates strongly with Hans Jonas's principle of responsibility. In *The Imperative of Responsibility*, Jonas (1979) argues that the power of modern technology has extended far beyond the traditional spatial and temporal limits of human action, and thus ethics must expand to encompass care for future life and nature⁷⁹. Building upon this foundation, Peter-Paul Verbeek transforms responsibility from an abstract "duty toward the future" into a form of present action within design practice. Through his methodology of experimental ethics, Verbeek contends that ethical judgment should not remain confined to the level of normative reflection but should instead be embedded in the concrete processes of design, allowing technological artifacts themselves to become mediators of moral responsibility.

Anticipatory responsibility also concerns collective interests. Designers should conduct stakeholder analysis and incorporate the needs of diverse groups. In health technologies, for example, patients, clinicians, regulators, and firms all have legitimate stakes. Responsible design serves individuals while promoting equity, health, and sustainability at the societal level.

Because artifacts are material mediators, design carries moral weight. Structure, interface, default settings, interaction sequences, and feedback loops shape conduct. In automated systems this shaping can extend to decision substitution. The design of autonomous vehicles exemplifies this challenge. Engineers must specify how systems evaluate acute dilemmas and encode ethically acceptable decision procedures.

79 Jonas, H. (1979). *Toward a philosophy of technology*. Hastings Center Report, 34-43.

Responsibility becomes materialized in architecture and behavior scripts. It is not restricted to whether a component functions as specified. It includes the ethical consequences that flow from operation in the world.

However, unlike Hans Jonas's emphasis on ontological responsibility, Peter-Paul Verbeek's design ethics places greater stress on the embeddedness and practicality of responsibility. He seeks to internalize ethics within the process of technological design in order to avoid the externalization or deferral of responsibility. Yet, this proposal has also faced criticism from philosophers of information. Luciano Floridi argues that in a highly networked information ecology, responsibility is no longer an action that can be borne by a single agent but must instead be distributed across the entire informational system⁸⁰. In other words, the responsibility of technology designers cannot be understood in isolation; it must be situated within a dynamic ethical structure that includes algorithmic governance, data circulation, and social feedback mechanisms.

The mediating function of technology is the channel through which anticipatory responsibility is realized. Social platforms illustrate the point. Beyond technical performance, mechanisms are required to discourage harassment and misinformation and to guide responsible participation. Designers therefore bear obligations to consider social functions and ethical effects, not only efficiency or growth metrics.

Under this model designers are producers and also custodians of social values. Through design and mediation they shape how technologies influence behavior and institutions.

80 Floridi, L. (2013). *The ethics of information*. Oxford University Press (UK).

Engineering practice becomes an activity with ethical and civic significance. The role of the engineer expands from executing specifications to integrating values into artifacts in order to secure social well being.

Verbeek's view places strong demands on practitioners. It presumes technical expertise together with competence in ethics, social science, economics, and philosophy. In practice many engineers lack such broad preparation. Multidisciplinary teams can share responsibility, yet communication barriers and value conflicts may slow development. Greater ethical review and institutional constraints may reduce speed and efficiency in innovation. Verbeek's emphasis on responsibility may therefore underestimate market pressures and efficiency logics. This tension calls for further discussion and for governance models that support responsible design without stifling practicable progress.

5.2 Distributing Ethical Responsibility Social Obligations in Technology Design

5.2.1 Responsibility Ethics in AIGC Design

As an emerging technological modality, AIGC is profoundly reshaping multiple sectors, especially content creation, education, healthcare, and entertainment. Its design and application concern not only technical innovation but also the ethical responsibilities that follow. These responsibilities extend beyond effectiveness and efficiency. They also include the ethical effects of technology as it drives social change and shapes human behavior and decision making.

In AIGC design, the distribution of responsibility becomes especially important. Unlike traditional technologies, AIGC is not a mere tool. It is a complex system deeply interwoven with human behavior and social relations⁸¹. Through algorithms and data analysis, it generates content that can influence cognition and behavior, which creates substantial ethical challenges. Designers must proactively assume responsibility, ensuring that design and deployment do not deviate from social ethical norms and avoiding potential harms to users.

The distribution of moral responsibility is a key issue in AIGC design. Traditional approaches often assign responsibility to developers or end users. In AIGC contexts the allocation is more complex. AIGC is the product of developers and is also an intelligent system that exhibits a degree of autonomy. Designers, developers, users, and the AIGC system itself all play significant roles in the allocation of responsibility.

In the design process, first, developers and designers must bear responsibility for moral design. As creators and promoters of AIGC, they must understand its possible ethical impacts and actively prevent discrimination, bias, or the spread of false information through generated content. For example, developers should rigorously review training datasets to avoid biased data and to ensure diversity and fairness in outputs. Designers should also establish ethical review mechanisms during development so that generation remains within moral and legal boundaries.

81 Sun, H., & He, Y. (2023, October). The application and user acceptance of aigc in network audiovisual field: Based on the perspective of social cognitive theory. In Proceedings of the 7th International Conference on Computer Science and Application Engineering (pp. 1-5).

Users likewise bear responsibility for how they employ AIGC systems. Although AIGC can automatically produce content, the ways users apply that content in real contexts remain ethically significant. Users must cultivate technical literacy and ethical awareness and must not use AIGC for malicious purposes such as fabricating misinformation, spreading defamatory speech, or publishing false news. Users should also consider copyright. Because training corpora often include large-scale data drawn from existing works, generated outputs may resemble prior works in style, form, or expression, which creates potential copyright disputes. If users commercialize or publicly distribute such material without due diligence, they may infringe on authors' rights and violate intellectual property law.

The AIGC system itself should be endowed with a measure of moral responsibility. Although current systems are not fully autonomous, future systems may exercise greater independence in decision making. Designers should therefore consider behavioral norms and ethical constraints at development time and create systems with ethical checking and self-adjustment capacities so that they can follow social ethical requirements across contexts. This means developers are responsible not only for functionality but also for social impact.

During design, the establishment of an ethical framework is crucial. Designers should build a comprehensive framework to guide development and application. It should comply with current standards and be adaptable to future challenges. Issues include avoiding black box effects, ensuring diversity and inclusiveness in outputs, and

preventing malicious misuse. The framework should prioritize social justice, privacy, and data security so that design and application do not intensify inequality or harm individual rights.

Regulators also play an important role in distributing responsibility. As AIGC spreads, governance has become a global concern. Regulators should issue clear rules that prevent AIGC from exceeding ethical and legal boundaries. These rules should cover data privacy, authenticity in content creation, and explainability. They should require periodic audits to ensure transparency and compliance.

In sum, distributing ethical responsibility in AIGC design is complex and multilayered. It involves developers, users, the system itself, and regulators in shared accountability. Responsibility is not only retrospective attribution for outcomes. It is a proactive process of anticipating ethical effects and mediating them through design. Balancing responsibilities and ensuring ethical compliance will be a central task for future innovation.

5.2.2 The Social Functions and Practices of Responsibility

In technological societies, responsibility is more than a constraint on individual conduct. It has deep social functions. Responsibility regulates social interaction and promotes justice and the public good. With AIGC, these functions become more salient and cannot be ignored in design and implementation. AIGC comprises automated content generation, personalized recommendation, and intensive data analysis. These

capabilities increase efficiency and creativity, yet they also raise complex ethical and social issues.

One key social function of responsibility is establishing and maintaining social norms. AIGC influences content production, media dissemination, and data processing. It affects public opinion, social trust, and cultural values. Responsibility guides designers, users, and other stakeholders in understanding and using AIGC appropriately, and in complying with ethical and legal requirements during design, development, distribution, and use⁸². Responsibility serves as moral mediation by defining boundaries that prevent misuse and improper handling of information.

For example, when AIGC is used for news generation or opinion shaping, designers must ensure that outputs meet ethical requirements and do not mislead audiences or propagate false or biased information. Similarly, applications in education and healthcare must observe ethical norms and legal standards to avoid injustice, data breaches, or other crises. Clear responsibility frameworks help society regulate use, sustain healthy interaction between technology and social life, and keep technology aligned with human and social well being.

Another function is fair allocation. Responsibility in technological societies is rarely borne by a single actor. Many stakeholders take part, including developers, users,

82 Mei, J. (2025, July). A Study on Copyright and Attribution Issues in Artificial Intelligence Generated Content (AIGC). In 2025 11th International Conference on Humanities and Social Science Research (ICHSSR 2025) (pp. 1270-1276). Atlantis Press.

regulators, and governments. Responsibility should be distributed fairly and rationally so that technological progress and social justice advance together.

Deepfake technologies illustrate the point. They enable highly realistic fabricated video and audio and can be used for creative purposes but also for misinformation and identity theft. Developers bear responsibility to embed safeguards, restrict misuse, and add warnings that prompt authenticity checks. Users must comply with moral and legal norms and avoid malicious use, such as fabricating statements by public figures for political manipulation. Governments and regulators must act as well. The European Union's GDPR, for instance, defines strict rules for data privacy and misuse and requires explicit consent and stronger protection measures⁸³. Regulators should also enforce penalties for illegal uses, such as online fraud or the dissemination of falsehoods. This multi actor cooperation helps ensure legitimate use and reduces social harm.

Fair distribution of responsibility also fosters trust. As AIGC expands globally, preventing undue advantage by particular interests has become urgent. Verbeek's conception of responsibility underscores not only retrospective attribution but also maximizing social welfare through design and use while avoiding unequal applications that exacerbate injustice.

83 Li, H., Yu, L., & He, W. (2019). The impact of GDPR on global technology development. *Journal of Global Information Technology Management*, 22(1), 1-6.

Responsibility further functions as social regulation in everyday practice. Technology acts as a catalyst for social conduct. It changes individual behavior and reshapes social structures. Responsibility keeps applications aligned with moral values and public interest.

Automated news generation is a case in point. Agencies such as the Associated Press and Reuters already use AIGC to generate data driven stories. The benefits are speed and scale. Yet responsibility issues arise. If an automatically generated report on a financial event relies on erroneous or incomplete data, it can mislead the public and trigger market turbulence. Because such texts are not written by journalists and because algorithms may miss bias or reliability concerns, accuracy and fairness suffer. Platforms and newsrooms then face ethical and legal pressure. News organizations should establish validation and editorial review pipelines. Platforms should monitor automated publishing and prevent the spread of inaccuracies. Users should read critically and avoid sharing unverified reports. With responsibility as a moderator, AIGC can enhance efficiency while preserving quality and social duty(Fig. 8).



Fig. 8. News about the exposure and decryption of AI-generated fake "moon

landing hoax studio" photos. If the author hadn't stated in the fake news that it was

a joke, these highly realistic AI photos could have easily been believed as true by

many people. (Source: WeChat Official Account "Dimensionality Reduction

Lab", Author: Wei Xi)

Responsibility also has a practical dimension. It must be enacted, not only affirmed in principle. In AIGC design and application, this means embedding ethical review in algorithms, incorporating clear privacy protections, and ensuring that generated content aligns with social and moral norms. Designers should use the mediating capacities of technology to supervise user behavior and content generation effectively. The goal is to prevent misuse and to produce positive social impact in real settings.

5.3 Ethical Challenges of Responsibility in the Acceptance of AIGC

5.3.1 A Global Perspective on Technological Responsibility

With the rapid advance of AIGC, responsibility questions have grown more complex, especially under globalization. These technologies reshape social structures and values across borders and provoke worldwide ethical reflection. The global perspective involves how technologies are applied across different cultures, legal regimes, and economies, and how responsibility is recognized and distributed across jurisdictions.

This requires rethinking the far reaching social effects of technology, including use, misuse, and latent risks.

A central challenge is divergent understandings of technology ethics among nations and regions. Differences appear in law and policy and also in cultural cognition, social values, and moral standards for application. Data privacy illustrates the divergence. The European GDPR emphasizes privacy and protection. The United States has comparatively looser frameworks. Such differences complicate operations for multinational firms and raise the question of how to maintain consistent responsibility ethics across legal systems.

Technological effects cross borders and can reshape politics, economies, and social orders elsewhere. In some contexts AIGC may be misused for political manipulation or information warfare, which complicates responsibility allocation. Global application therefore calls for international cooperation. Countries should collaborate on ethical standards so that cross border use complies with local laws while respecting shared ethical commitments. Globalization also disperses responsibility. Companies operate internationally and cannot be governed by a single legal system. A global framework must balance legal differences, cultural backgrounds, and social needs, and then define common standards for responsibility.

However, relying solely on unified ethical standards or international regulatory frameworks cannot adequately address the globalization challenges of technological

responsibility. As the philosopher of technology Yuk Hui points out, the global technological system often conceals the profound cultural divergences in how different civilizations understand the meaning of technology. In *The Question Concerning Technology in China*, Hui introduces the concept of cosmotechnics, arguing that every culture possesses its own way of understanding the relationship between technology and cosmic order⁸⁴. In other words, technology is not a universally neutral product of rationality but is deeply embedded within the cultural, religious, and historical practices of each society.

From this perspective, a global ethics of responsibility should not be viewed as the "globalization of Western moral norms," but rather as the coexistence and negotiation of multiple technological worlds. Hui criticizes the current trend of technological globalization as a form of technological colonialism—one that takes Western technological rationality as the universal standard while marginalizing or erasing other cultural understandings of technology and ethics. This monolithic logic results in a version of "global responsibility" that, in practice, masks a process of cultural homogenization. The worldwide diffusion of AIGC technologies exemplifies this issue: their algorithmic models, datasets, and design frameworks are largely rooted in the Anglophone world, thereby embedding specific cultural biases and value assumptions into their very architecture.

84 Hui, Y. (2019). *The question concerning technology in China: An essay in cosmotechnics* (Vol. 3). mit Press.

For example, when AIGC systems generate language, images, or texts, the corpora they rely on are often drawn from Western-dominated knowledge systems. As a result, non-Western cultures-their languages, epistemologies, and modes of expression-become marginalized within the logic of the technology. This algorithmic cultural hegemony not only produces epistemic imbalance but also reinforces structural asymmetries in the global distribution of ethical responsibility. Therefore, global responsibility ethics should not focus solely on the question of "who is responsible," but must also ask "which conception of technology" defines the very logic and scope of responsibility.

In *Technics and Temporality*, Hui further argues that technodiversity is the necessary precondition for a truly global ethics of technological responsibility. If the world is governed by a single mode of technological rationality, then all ethical discourse will be subsumed within that same framework, erasing cultural difference and ontological plurality. A genuine global technological ethics must therefore be grounded in respect for technological pluralism, allowing diverse civilizations to contribute their own understandings of technology to a shared global framework of responsibility. This means that constructing an AIGC ethics of responsibility must draw on multiple cultural sources of technological wisdom-such as Eastern ideas of harmony and wholeness, the African Ubuntu notion of relational responsibility, and the Western emphasis on individual freedom and accountability. Only through the interaction of multiple ethical traditions can global responsibility achieve true universality and inclusiveness.

Another key issue raised by technological globalization is the dispersion of responsibility. Although AIGC technologies exert global influence, their regulation and implementation vary greatly across nations and regions. Technology companies often operate transnationally, beyond the reach of any single legal system, which makes the distribution of global technological responsibility complex and fragmented. A truly global ethical framework must address how to balance these differences in legal systems, cultural contexts, and social needs, and must do so without sacrificing diversity. As Hui warns, such "unity" should not come at the cost of cultural distinctiveness; rather, it should take the form of a "pluralistic and dialogical unity"-a global consensus achieved through cultural translation and ethical negotiation rather than through the imposition of uniform standards.

Transnational cooperation plays a crucial role in this process. The international community must work collectively to establish globally adaptable ethical standards to ensure the fair and just use of AIGC technologies worldwide. Organizations such as the United Nations and the World Economic Forum can facilitate collaboration among governments and multinational corporations, providing guidance for the equitable distribution of responsibility. At the same time, a global ethical framework must not only harmonize legal and institutional systems but also foster cultural and philosophical dialogue, promoting shared understanding while safeguarding national interests.

From Hui's perspective, this kind of global cooperation is not merely an institutional arrangement but a cultural-philosophical challenge. True global ethics does not emerge from the normative export of any single dominant civilization, but from the reinterpretation and co-creation of technological meaning among diverse cultures. The ethical distribution of responsibility in AIGC must therefore embody this decentralized ethics, establishing cultural bridges of "technological mutual recognition" across civilizations.

Nevertheless, despite the importance of a global ethical framework, its implementation remains fraught with challenges. Cultural diversity, political structures, and social systems all shape how technology is applied and ethically evaluated in different regions, making the establishment of universal standards particularly difficult. Nations often hold divergent views on key issues such as data privacy, AI ethics, and technological misuse, further complicating the possibility of a unified global framework.

For this reason, Hui emphasizes that "the future of technological ethics does not lie in the search for universal truths, but in the recognition of technological diversity and difference"⁸⁵. The globalization of AIGC ethics should thus be understood as a process of technocultural symbiosis, not of homogenized global governance. Only when different cosmotechnical traditions can coexist, complement, and engage in dialogue will technological responsibility truly reflect global fairness and ethical justice.

85 Hui, Y. (2020). Writing and cosmotechnics. *Derrida Today*, 13(1), 17-32.

As AIGC technologies continue to evolve, the ethical challenges surrounding technological responsibility will become increasingly complex. The global community must therefore strengthen cross-border collaboration in technology development, application, and regulation to ensure the equitable and ethical use of AI on a worldwide scale. Such collaboration is not only a matter of legal and institutional coordination but also one of cultural and philosophical reintegration. The construction of a global ethics of responsibility must strike a balance between technological rationality and cultural diversity, ensuring that the future of AIGC becomes not an extension of a single civilization but a coexistence of multiple cosmotechnical worlds.

5.3.2 Designing Responsibility Ethics for Future AIGC

As AIGC evolves, responsibility ethics must address present challenges and lay a foundation for the long term. Future design should be comprehensive, flexible, and anticipatory. Ethical responsibility should be considered at every stage and adjusted through practice.

First, responsibility ethics should begin at the earliest research and development phases. Anticipatory design integrates ethical reflection throughout development, not after the fact. Developers need heightened ethical awareness and the capacity to foresee moral risks, including bias, privacy violations, and unfairness. By embedding ethical

considerations at the outset, engineers can proactively control risks and avoid unnecessary harm.

Second, responsible design should include social impact assessment. Design should address social consequences alongside technical requirements. Assessment should become a standard step and should consider contextual fit, cultural influence, and fairness⁸⁶. For example, in education and healthcare, developers should ask whether applications intensify inequality or disadvantage vulnerable groups. Cross disciplinary collaboration among technologists, sociologists, ethicists, and legal scholars is essential so that applications remain fair and inclusive.

Transparency and traceability are also essential. As systems grow more complex, many decisions are algorithmically generated, making processes opaque. To strengthen social trust, future AIGC should provide transparent decision mechanisms. Users, regulators, and the public should be able to understand how decisions are made. Design should include clear feedback channels that reveal model rationales and data sources so that stakeholders can evaluate reasonableness and morality. Transparency and traceability increase accountability and help prevent misuse.

User education and technical literacy are necessary as well. Responsible application depends on users. Designers should include educational components that guide

86 Wu, J., Cai, Y., Sun, T., Ma, K., & Lu, C. (2025). Integrating AIGC with design: dependence, application, and evolution-a systematic literature review. *Journal of Engineering Design*, 36(5-6), 758-796.

responsible use. Clear instructions and risk disclosures can help users understand privacy, bias, and other concerns and can reduce misuse.

Cross boundary collaboration and multi stakeholder participation will be central. Given the complexity and cross sector impact of AIGC, responsible design must integrate insights from philosophy, sociology, law, and ethics. Developers, scholars, governments, firms, and users should participate in design, assessment, and oversight so that technologies meet social needs while minimizing ethical risks.

Finally, responsible design must address sustainability. Ethical issues will evolve over time. Developers should adopt a long range view of life cycles and consider social, environmental, and cultural impacts across generations. This requires anticipatory thinking and an intergenerational sense of duty.

Designing responsibility ethics for AIGC is a complex systems task. Ethical reflection must be integrated into every stage. By strengthening responsibility in design, AIGC can better serve society, promote human flourishing, and avoid risks. This requires engineers, regulators, and the wider public to maintain a strong sense of responsibility and to refine ethical design continuously so that technology and society develop in coordination.

Chapter 6 Applications of Verbeek's Philosophy of Technology in

Interaction Design

6.1 Basic Concepts and Value Orientation of Interaction Design

6.1.1 Definition and Background of Interaction Design

Interaction design refers to the design process through which designers enhance the quality of interaction between users and products or services. It focuses on making interaction between users and systems, devices, and interfaces more effective, pleasant, and intuitive⁸⁷. The core goal is to optimize communication between users and technological products and to create interfaces and interaction flows that meet user needs, are easy to use, and offer a positive emotional experience.

The history of interaction design can be traced to the 1960s and 1970s when the use of computers and electronic devices moved from academic and industrial contexts into broader society. As personal computers spread, users faced increasingly complex technological interfaces, and traditional hardware controls such as buttons, switches, and knobs no longer satisfied operational needs. This context spurred the rise of interaction design, especially in graphical user interfaces and usability testing. Early interaction design focused on improving operational efficiency and reducing difficulty through clear interfaces and functional layouts.

In the twenty first century, with the development of smartphones, tablets, wearables, and virtual reality, the scope and meaning of interaction design expanded.

⁸⁷ Kolko, J. (2010). Thoughts on interaction design. Morgan Kaufmann.

Contemporary interaction design goes beyond traditional usability to emphasize convenience, emotional design, and experience design. Users expect not only convenience but also enjoyment, a sense of achievement, and recognition while using products. The scope is no longer limited to physical interfaces and screens. It now integrates multiple sensory modalities including sound, touch, and even biofeedback.

With the rapid growth of artificial intelligence and machine learning, interaction design has entered a new stage. AI can interact more naturally with users through speech and vision and it can adapt to preferences and behaviors through personalized recommendations⁸⁸. Voice assistants, smart home devices, and automated AI customer support all require interaction designers to embed intelligent elements so that products meet needs and also build emotional connections with users.

Against this backdrop, interaction design has become an interdisciplinary field involving psychology, human computer interaction, design studies, information science, and ethics. Driven by intelligent technologies, interaction design is not only a functional task. It also carries the mission of mediating human behavior and cognition and shaping social interaction patterns and cultural identities. Modern interaction design therefore asks how to guide user behavior, values, and social responsibility through design, not only how to make technology easier to operate.

88 Stige, Å., Zamani, E. D., Mikalef, P., & Zhu, Y. (2024). Artificial intelligence (AI) for user experience (UX) design: a systematic literature review and future research agenda. *Information Technology & People*, 37(6), 2324-2352.

This interdisciplinary character means interaction design extends beyond products and connects deeply with philosophy of technology and ethics. Under the spread of AIGC and smart devices, interaction design faces complex ethical and social challenges. Verbeek's philosophy, especially his insights on technological mediation and moral materialization, provides a new lens for understanding and addressing ethical and responsibility issues in interaction design. Within this framework, interaction design aims not only to enhance experience but also to establish new harmonious relations among technology, human behavior, and social values.

6.1.2 Insights from Verbeek's Philosophy of Technology for Interaction Design

Verbeek's philosophy, especially the concepts of technological mediation and moral materialization, offers profound insights for contemporary interaction design. His thought emphasizes the tight relationship between humans and things and how technology affects and shapes these relations. His idea of composite intentionality shows that when the directedness of things overlaps with human intention, technology forms a new kind of technological intentionality. This aligns closely with the essence of human computer interaction, whose purpose is to foster interaction and cooperation between humans and technology. For Verbeek, technology is not passive⁸⁹. It actively mediates and shapes behavior, thought, and social relations. This matches the aims of interaction design, which should not only optimize experience but also guide behavior through design and promote social value.

⁸⁹ Verbeek, P. P. (2024). *Moralizing technology: Understanding and designing the morality of things*. University of Chicago press.

The key lesson from technological mediation is that designers should adopt an active stance toward how technology influences user behavior and cognition. In traditional philosophy of technology, technology is often treated as a neutral tool and meeting functional needs is central to design⁹⁰. This study employs Verbeek's notion of technology should actively mediate behavior and cognition through its design and functions. For example, when designing interactive products, designers should consider not only efficiency and ease of use but also whether the technology can positively affect user autonomy, emotional identification, and social responsibility in use. Interaction design becomes a process of mediation in which designers consider at every step how technology can exert positive social functions and lead users toward behaviors aligned with ethics and social values.

Moral materialization further guides interaction design. Technology is not only a tool for realizing functions, it is also a carrier of ethical norms. Through design, technical artefacts not only mediate behavior but also internalize values that influence moral judgement and social conduct. Designers should therefore combine ethical standards with technical functions, so that products naturally encourage ethically appropriate behavior during use. Hidden design choices such as recommendation logic, privacy protections, and guidance strategies can shape decisions and behavior, turning technology into a vehicle for social ethics. This enhances social responsibility while directing users toward more moral and rational courses of action.

⁹⁰ Verbeek, P. P., & Kroes, P. (Eds.). (2014). *The moral status of technical artefacts*. Springer.

Moral materialization also implies that designers bear social responsibility. In the application of AI and big data, the responsibilities of interaction designers become more significant. Designers must ensure that technology does not cause social harms. On social platforms, for instance, privacy protection is an ethical issue as well as a technical one. Designers should secure data and also consider how to balance privacy with platform interests, avoiding excessive control or moral manipulation. They should anticipate and address ethical issues in advance and ensure that technology remains aligned with moral and social principles.

Verbeek's responsibility ethics stresses forward looking responsibility rather than responsibility only after problems appear. Traditionally, designers corrected issues after the fact. Verbeek urges them to consider potential risks and problems from the outset and to avoid later ethical pitfalls through anticipatory responsibility. As smart and AI systems grow more complex, chains of responsibility become more ambiguous. Designers should foresee possible issues at the design stage and reduce later risks and dilemmas. This improves quality and safety at the source and supports healthier technological development.

Verbeek's philosophy also offers a new view of joint human machine responsibility. In traditional attribution, designers, developers, operators, regulators, and users are separate responsible agents. This study employs Verbeek's notion of humans and technology co constitute social ethics. Responsibility should be shared by humans and intelligent artefacts understood as a coupled system. In interaction design,

responsibility should be determined through human technology interaction. Under this joint responsibility model, designers, developers, and users participate together in moral decision making and share the ethical consequences of technological application. This clarifies and rationalizes responsibility while keeping products on an ethical track.

6.1.3 Value Orientation in Interaction Design

Value orientation guides practice in interaction design. It determines how designers interpret and respond to user needs and how they integrate social, ethical, and cultural considerations. As technology and society change, value orientations evolve. Under AI and AIGC, interaction design must go beyond experience to assume social responsibility and promote fairness and moral values.

The primary orientation is user centeredness. All decisions should revolve around user needs, expectations, and behavior. User centered design emphasizes understanding user goals, tasks, and contexts in order to create intuitive, usable, and need aligned products. Designers should not only optimize functions and interfaces but also attend to emotional needs and experiences to raise satisfaction and loyalty. With the growing complexity of needs and behaviors under AI and AIGC, designers must consider how technology aligns with user cognition, emotion, and ethics. For example, when designing AI assistants, designers should consider intelligence and convenience, and also trust, emotional connection, and the protection of user autonomy.

Ethical care is another essential orientation. Verbeek emphasizes that technology is a powerful force that shapes behavior, cognition, and social structures. Ethical care requires designers to consider potential impacts on behavior and society and to ensure that products meet functional needs while promoting social welfare and moral values. In privacy design, for instance, designers should balance protection and performance. Design should prevent data leaks and ensure that users feel respected and protected. In the era of AI and big data, designers must assume responsibility for society, users, and the environment, avoiding data misuse and algorithmic discrimination.

Cultural adaptability is also crucial. Design must consider the cultural contexts of users. Habits, cognition, and behavior vary across cultures. Interaction design should balance globalization and localization. Culture aware design improves acceptance and experience. Verbeek's view of technological mediation reminds designers to attend to how technology shapes cultural identity and social behavior. Designers should tailor solutions to cultural background, values, and social practices and avoid cultural conflict and misunderstanding brought by technology.

Social responsibility is another core orientation. As AI and smart technologies penetrate many domains, designers must ensure that products benefit society rather than intensify inequality. In algorithm design, for example, fairness and transparency are essential, and discriminatory bias must be avoided. Interaction design should lead behavior positively in real use and contribute to overall welfare. Designers should consider how

to improve public services, education, and healthcare through design and how to advance fair distribution of resources.

Sustainability is an important orientation as well. Under climate pressure and resource scarcity, interaction design should address environmental, social, and economic sustainability. Designers should consider resource use, energy efficiency, repairability, and end of life over a product's lifecycle. In AI and smart devices, sustainability also means using technology to support environmental protection and conservation. Designers should leverage technology to promote green energy, reduce e waste, and enhance resource efficiency. This is both a functional requirement and a social responsibility. Each new technology should be assessed for long term environmental and social impacts.

6.2 Applications of Technological Mediation in Interaction Design

6.2.1 The Mediating Role of Technology in Interaction Design

As one of the core concepts in Verbeek's philosophy of technology, technological mediation emphasizes that technology is not merely a tool but an agentive force that shapes human behavior, cognition, and social relations. In interaction design, this mediating role is expressed above all in how design and functionality profoundly influence users' behavioral patterns, emotional experience, and social interaction. Designers should therefore look beyond functionality and user needs to recognize

technology's potential to shape behavior and values, achieving designs with greater humanistic concern and social responsibility.

First, mediation appears in how systems guide user behavior and decision making. Traditional interaction design has often focused on functionality, usability, and ease of operation. With intelligent technologies, however, interaction design no longer centers only on physical convenience; it increasingly concerns how design steers behavior and choices. For example, in new-energy smart vehicles, in-car HMI systems can influence drivers' choices through ADAS features, energy-consumption prompts, and route recommendations. When the system proposes the "most energy-saving route" based on real-time traffic and battery level, drivers tend to follow it and gradually form more sustainable travel habits. Such mediation not only makes driving safer and more convenient; it also subtly promotes values of efficiency and environmental stewardship⁹¹. Designers must strike a balance here: on the one hand, enhancing the driving experience; on the other, preventing overreliance so drivers retain autonomous judgment and a sense of responsibility.

Second, mediation operates through emotional design and user experience. As UX has matured, interaction design has moved beyond function and efficiency to include care for users' emotions. Through design, technology can shape users' affective responses, cognitive patterns, and social connections. AIGC, for instance, spanning AI-generated art, text, and music can automatically create personalized content based on user

91 Pandey, A., & Joseph, J. (2025). Human-Machine Interaction: Ethical and Legal Considerations. In *Exploring AI Implications on Law, Governance, and Industry* (pp. 179-202). IGI Global Scientific Publishing.

preferences. In doing so, AIGC is not a mere automation tool; by modulating style, emotional tone, and theme, it can evoke resonance and reconfigure users' psychological and cognitive experience.

A salient example of AIGC in interaction design is Meta's Horizon Workrooms, a VR collaboration platform offering more immersive and personalized remote work. Leveraging AIGC, the platform recognizes facial expressions, voice, and behavioral patterns and dynamically adapts interactions in the virtual environment. Through intelligent algorithms, avatars' voices and intonation and the ambient atmosphere adjust to users' emotional states. When the system detects fatigue or anxiety, a virtual assistant may suggest short relaxation breaks or shift background music and lighting to relieve stress. More specifically, based on deep learning over past interactions, the system recommends and tunes personalized elements, e.g., meditation interludes or environment adjustments aligned with users' rhythms, ensuring emotional and psychological needs are acknowledged. By reinforcing affective resonance, this mediation increases emotional engagement and identification in work settings.

Furthermore, technological mediation helps shape social behavior and values. Technology influences not only individuals but also groups and society at large. Interaction design serves as a bridge in this process, helping technology integrate into social life and disseminate social values. Smart social platforms, online education systems, and intelligent healthcare systems all rely on mediation to promote connection, learning, and healthy behavior. For example, social platforms not only support

interaction but also modulate information feeds based on behavioral data, affecting emotions and social conduct. While such mediation can enhance experience, it also raises ethical concerns such as information overload and privacy. Thus, a key task for designers is to employ mediation to foster pro-social behavior and value formation while mitigating risks.

In short, the mediating role of technology in interaction design goes far beyond functional delivery. It concerns how design steers behavior, emotions, and social conduct. Within Verbeek's framework, interaction design becomes a process of mediating relations between users and technology and between individuals and society. Designers must grasp mediation's potentials and impacts to ensure enhanced user experience aligns with positive social and cultural development.

6.2.2 Mediation Mechanisms of AI in Interaction Design

In interaction design, AIGC's mediation mechanisms show great promise, especially for affective interaction and behavioral modulation. With advances in big-data analytics and deep learning, AIGC is no longer just an information conduit; by recognizing emotions and predicting behavior, it proactively adjusts users' affective responses, cognitive patterns, and choices-enabling more humane and deeply attuned experiences. At the core is analysis-and-feedback: technology senses and modulates emotional state, cognitive response, and behavioral selection in real time.

These mechanisms attend not only to functional needs but also to emotion and psychology. Researchers have proposed innovative frameworks that integrate emotion recognition, real-time adaptation, and personalized content generation to elevate intelligence in interaction. By embedding affective analytics into human-technology encounters, AI can dynamically adjust content and interaction styles based on users' emotions. In smart UI design, for example, multimodal recognition of facial expressions, voice, and haptic signals lets systems sense affect and adapt presentation accordingly, smoothing interaction and strengthening emotional connection-making technology feel more "attentive" and personalized.

A representative application is the "Flower Experiment"(Fig. 9). This interactive art installation explores how AI can analyze participants' emotions in real time and mediate affective feedback during interaction. Participants touch and observe a stylized flower, eliciting varied emotional responses. AIGC captures these interactions and analyzes affective fluctuations on the fly, converting them into feedback that guides designers to adjust the flower's presentation and generated content to better fit participants' emotional needs. When users touch petals or watch transformations, emotions-delight, curiosity, surprise-are detected and translated into data that reveal how emotions evolve through object interaction. The flower thus becomes not only an artwork but also a carrier of affect through AI-driven mediation, demonstrating how design forges a feedback loop between human emotion and technological response.



Fig. 9. Photo of the flower experiment at the Guangzhou Urban Art Season exhibition.

Crucially, the experiment extends beyond one-to-one encounters. Throughout the day, the flower logs all interactions and synthesizes an emotion-infused artwork reflecting

the cumulative positive and negative affect it received. The final form mirrors both individual emotions and the aggregate effects of collective behavior. Viewers are prompted to consider how small acts an idle touch or neglec, leave traces in the whole. By analogy with education, it suggests that minor daily behaviors can profoundly shape a child's growth and character, provoking reflection and self-awareness(Fig.10).



Fig. 10. Final artwork generated from prompts based on data collected from the exhibition.

The technical workflow of this artwork comprises two interrelated components: a physical interactive device for data acquisition and an AIGC-based system for real-time generation and visual feedback. Through continuous signal processing and generative image linkage, the work establishes a closed-loop interaction mechanism of "sensing—translation—generation—feedback."

The first component is the physical interactive installation responsible for collecting user interaction data (Fig. 11). To ensure durability in long-term exhibition scenarios

while maintaining a tactile and accessible interface, the device adopts leaf-shaped carriers woven from nylon fabric and yarn. This material strategy not only guarantees structural resilience and maintainability but also conveys a soft, warm, and nature-oriented tactile metaphor, an element that lowers the participation threshold and encourages audiences to engage through touching, pressing, and lingering. The installation is integrated with multiple sensing modules (Fig. 12), including a pressure sensor (capturing touch intensity and duration), a humidity sensor (recording the frequency and intensity of audiences' simulated "spraying/watering" actions to reflect the rhythm and force of caregiving gestures), a photoresistor (capturing the intensity and duration of simulated "sunlight" created by audiences using a flashlight, thereby indicating their engagement level in modulating the light environment), and a sound-level sensor (collecting speech-based interactions: on the one hand, voice signals are captured via a microphone and converted into textual content; on the other hand, acoustic features such as loudness and vocal dynamics are analyzed to characterize tone intensity and emotional strength, transforming spoken expression into a computable interaction variable). By synchronously collecting multimodal signals, the system expands interaction from a simple "trigger-based input" to a richer behavioral dataset encompassing variations in rhythm, intensity, and temporal patterns, laying the foundation for more nuanced mapping in the generative process.



Fig.11 The physical entity of the interactive device

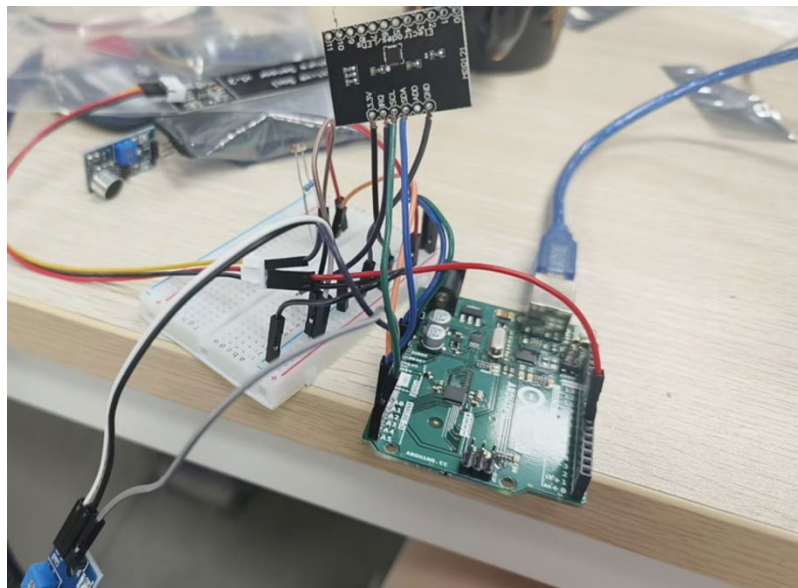


Fig.12 The sensor debugging of the connected interactive device

The second component is the AIGC-driven real-time generation and visual feedback system (Figs. 13 – 15). Sensor signals acquired by the device are transmitted to the

computing unit as electrical inputs and processed in TouchDesigner, which serves as real-time middleware for signal interpretation and preprocessing (e.g., threshold detection, range mapping, noise filtering, and smoothing). This enables the translation of continuous physical changes into computational interaction parameters. Based on these parameters, the system adopts a prompt-generation strategy: instead of triggering fixed commands, it dynamically constructs textual prompts by combining keywords, stylistic modifiers, and emotion/imagery tags in response to variations in pressure input, spraying/watering frequency and intensity, flashlight-induced sunlight intensity and duration, as well as spoken content and tonal intensity. In this way, the prompts evolve into individualized, behavior-sensitive templates, allowing both embodied actions and verbal expressions to integrate into the AIGC pipeline in a more expressive and differentiated manner.

Furthermore, the ComfyUI2TD plugin facilitates real-time synchronization between Stable Diffusion (ComfyUI workflows) and TouchDesigner. TouchDesigner transmits the generated prompts along with key generation parameters (e.g., sampling steps, style weights, noise strength, or optional reference image inputs) to ComfyUI, which then executes the Stable Diffusion workflow for image generation. The generated images are sent back to TouchDesigner as dynamic textures. Leveraging TouchDesigner's visual compositing capabilities, such as timeline-based control, particle systems, deformation effects, and layered post-processing, the system delivers immediate visual feedback during user interaction. This setup not only achieves perceptible real-time feedback but also abstracts audiences' behavioral traces and speech-driven affective

expressions into evolving AI-generated visual artworks, enabling cross-modal translation from embodied gestures and spoken language to generative image language. In doing so, the work integrates interactivity, real-time computation, and artistic representation, supporting both the experiential goals and conceptual narrative of the installation.

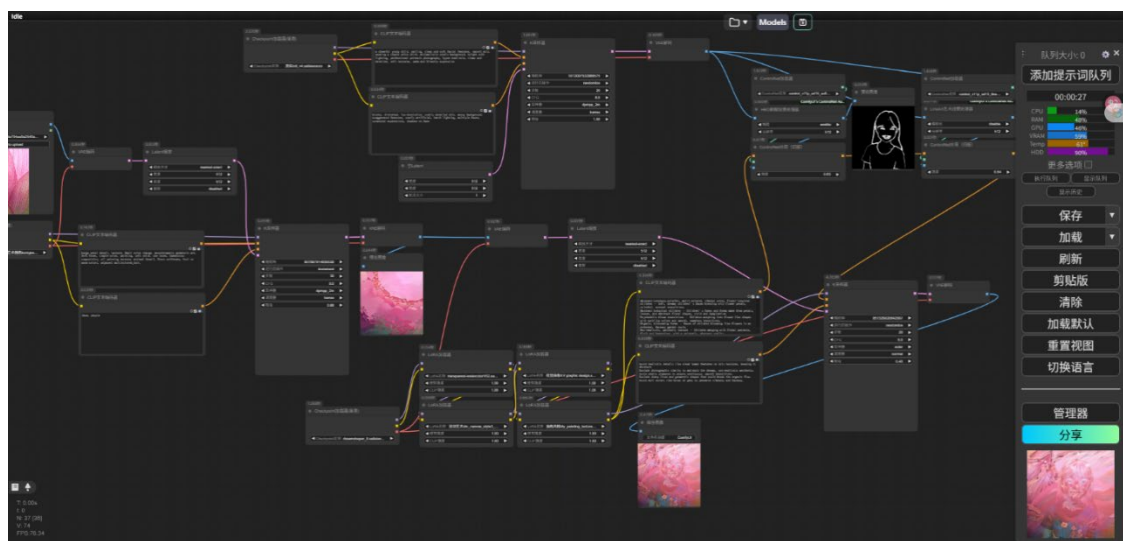


Fig.13 ComfyUI workflow



Fig.14 TouchDesigner sensor parsing workflow



Fig.15 The final display effect

Drawing on Verbeek's theory, the Flower Experiment serves as a compelling illustration of technological mediation between users and artefacts. Technology is never neutral; through deliberate design, it shapes human cognition, behavior, and emotion. In this case, AIGC not only analyzes affective states but also modulates the installation's presentation and content generation, thereby guiding users' emotional experiences—a dynamic of co-shaping precisely articulated by Verbeek.

The experiment can also be interpreted through Verbeek's concept of the materialization of morality. He argues that design has the capacity to embed ethical and emotional dimensions into artefacts, functioning as a means to guide and normalize human behavior. In the Flower Experiment, AIGC "materializes" ethics and affect within the artistic object, enabling technology to address both emotional and functional needs. This form of "emotional materialization" does not depend on explicit external rules; instead, implicit design mechanisms gently steer affective responses through technological mediation, fostering deeper emotional resonance between users and the work.

Such emotional materialization is not confined to interactive art installations; it can be extended to smart devices, virtual art, and interactive games. In virtual art, for instance, AIGC can dynamically adjust its presentation in response to users' emotional needs, enhancing their engagement with the work. Beyond optimizing visual and auditory elements, this affective mediation strengthens the relational bond between users and technology, transcending the latter's role as a mere tool.

Through these mechanisms, AIGC elevates the quality of human-technology interaction while modulating users' emotions and behaviors. By integrating intelligent affective analysis with real-time feedback, it transforms technology from a purely functional instrument into a medium for affective exchange—an outcome that echoes Verbeek's core proposition: technology mediates our relationship with the world, shapes our behaviors and cognitions, and exerts a profound influence on individual emotional lives. As such systems continue to advance, interaction design will become increasingly human-centered and affect-oriented, and the relationship between technologies and their users will grow ever more profound and intricate.

6.3 Practicing the Materialization of Ethics in Interaction Design

6.3.1 Defining and Applying Ethical Materialization

As noted earlier, "moral materialization," proposed by Verbeek, is one of the core concepts in his philosophy of technology. It stresses that technology is not a neutral instrument; values and norms are continuously embedded in design and use. Through ethical materialization, abstract moral ideals are translated into the structures, interfaces, and functions of technical artefacts, becoming a subtle guiding force in everyday practice. This means technology not only delivers efficiency and convenience; it also invisibly shapes users' attention, choices, and judgments so that behavior acquires a particular value orientation.

Unlike moral constraints that rely on law, custom, or social norms, ethical materialization emphasizes a regulation mechanism "born of the thing itself." Instead of appearing as external, coercive commands, it takes the form of design details such as "scripts," defaults, thresholds, and prompts that gently shape user behavior. For example, privacy-by-default settings, automatic activation of energy-saving modes, and instant error warnings embody the embedding of values in technical functions. These mechanisms enable technology not only to satisfy basic functional needs but also to play the role of a "member of the moral community" in its ongoing operation.

The significance of ethical materialization lies in breaking the human-thing binary and revealing the co-constitutive relation between human action and technical artefacts. Through design and interaction, technology not only shapes individual habits and value judgments; it can also, at a broader level, restructure the social ethical order. In other words, morality does not exist only in the subject's will or in abstract norms; it attains an embodied, operable, practical form via technical things. Hence, ethical materialization offers important theoretical insight for contemporary tech ethics: amid the rapid rise of emerging technologies (e.g., AIGC), designers should recognize that technology itself is part of morality. By intentionally embedding value orientations at the design stage, technology can generate soft ethical norms in everyday interaction, thereby avoiding an exclusive reliance on ex post regulation. Ultimately, ethical materialization reminds us that technological design and application concern not only efficiency and function but also the ongoing shaping of moral life and social order.

6.3.2 Embedding Ethics in Interaction Design

In interaction design, *ethical embedding* means incorporating moral ideas and social responsibility into the structure, functions, and workflows of interactive systems through concrete design practices. Verbeek's theory of ethical materialization supports this process by emphasizing that technology is not merely a means to meet user needs, but a "thing" that shapes conduct and orients morality. In this context, ethical embedding requires designers to consider, from moral and social-responsibility perspectives, how technology can influence user behavior while ensuring that such behavior aligns with social values and ethical norms.

First, ethical embedding is manifested in privacy protection and data security. As technology advances, personal data has become a vital resource, yet its collection and use bring risks of leakage and abuse. Designers must therefore build clear specifications and functions to protect privacy. On social platforms and e-commerce sites, designers can integrate privacy settings, data encryption, and transparent policies so that users know how their data is used and can freely choose whether to share it, embodying respect for privacy rights.

Second, ethical embedding concerns fairness and non-discrimination. In AI- and algorithm-driven design, systems must not produce bias against user groups based on gender, race, age, or other identities. For instance, recruiting systems can unintentionally discriminate against women or minorities if algorithms are not properly trained and tuned. Designers must therefore ensure algorithmic fairness, transparency,

and explainability to avoid bias. Doing so not only preserves justice in technology but also fosters users' sense of equality and respect, preventing unfair treatment or social inequality arising from technical systems.

Social responsibility is another key dimension. As technology permeates social life, designers should consider how design can maximize social welfare. In public-service design, for example, how can technology benefit marginalized groups and enhance inclusivity and equity? In smart-city design, the task is not only to improve management efficiency but also to ensure that all groups, especially low-income or vulnerable populations, enjoy the resulting conveniences and resources on equal terms. Embedding social responsibility means interaction design provides convenience for individuals while contributing to sustainable development for society as a whole.

Verbeek's ethical materialization helps us see that interaction design is not merely a technical issue but involves social, ethical, and cultural considerations. Designers should proactively ask how technology shapes social behavior and values, and how design can realize ethical guidance. With ethical embedding, design can elevate user experience while advancing collective welfare and steering technology toward greater fairness, transparency, and responsibility. As AI and big data continue to develop, ethical embedding in interaction design will only grow more important, demanding not just technical skill but heightened ethical awareness and social commitment from designers.

6.3.3 Materialization and User Autonomy

In Verbeek's theory, the "materialization" of technical artefacts is not only the translation of moral ideas; it is also a way in which technology acts within social behavior. Yet the relationship between materialization and user autonomy is complex. By internalizing moral norms into technology, materialization subtly guides user behavior, which may affect autonomy-especially when mediation and design nudges are at play. Whether users' space for free choice is compressed has become a central concern for designers and ethicists alike.

Materialization can, to some extent, *enhance* autonomy. Through ethical embedding, technology can offer options that better serve users' interests and social morality. Smart home devices, for instance, can automatically adjust environmental settings based on health conditions and habits. Such design lets users enjoy safe and comfortable living with minimal manual operation and encourages healthy routines. Here, materialization functions as "guidance toward freedom": intelligent design reduces cognitive load and decision pressure so that users can more easily make choices serving their long-term interests. In this sense, materialization supports rather than restricts autonomy.

However, materialization can also *constrain* autonomy. Verbeek stresses that technology is not neutral; its design influences cognition and behavior. Through ethical materialization, designers may-perhaps unintentionally-encode "oughts" or "shoulds," creating a form of "implicit control" in which choices are guided by embedded moral or functional norms. For example, some recommender systems tailor content based on past behavior, not only reflecting interests but also promoting mainstream values.

Although users remain free to accept or reject recommendations, the system's design already shapes preferences and choices, potentially reducing decision freedom. In such cases, materialization may limit autonomy by steering choices more than users' independent will does.

Verbeek's mediation theory offers a dynamic equilibrium: designers should enhance autonomy without overstepping into control. Materialization is not the crude imposition of norms but a careful guidance that raises social welfare and individual benefit⁹². Transparent design and algorithmic optimization can preserve users' choice space while offering guidance. In health-monitoring devices, for example, designers can provide multiple personalized settings so users freely choose their goals and lifestyles, rather than enforcing a single standard. In this way, materialized technologies both internalize social values and respect users' freedom.

Diversity of options and user empowerment are key to balancing materialization and autonomy. Designers should avoid turning design into overbearing intervention and instead provide varied pathways that honor user heterogeneity and independence. In personalization systems, for instance, allow users to control the recommender's priorities or opt out of certain categories. This avoids autonomy loss and helps users make decisions that reflect their values and interests-enabling a harmonious co-existence between technology and autonomy.

92 Verbeek, P. P. (2008). Morality in design: Design ethics and the morality of technological artifacts. In *Philosophy and design: From engineering to architecture* (pp. 91-103). Dordrecht: Springer Netherlands.

In sum, materialization and autonomy stand in a complex, not antagonistic, relation. With appropriate design, materialized technologies can guide users toward morally and socially desirable directions *and* strengthen their capacity for autonomous choice. The key is a continual sensitivity to technology's impact and a careful balance between guidance and freedom, ensuring that materialization expands users' options and respects autonomous decision making.

6.4 Applying Responsibility Ethics in Interaction Design

6.4.1 A Responsibility-Ethics Framework for Interaction Design

In Verbeek's philosophy, responsibility ethics is a core concept that calls on designers and developers to assume anticipatory ethical responsibility throughout design and application. Responsibility ethics addresses not only consequences but also the potential shaping of user behavior and social impact during design. In interaction design, a responsibility-ethics framework provides systematic guidance for integrating moral responsibility into design so that applications align with ethical norms and generate positive social outcomes.

First, the framework requires awareness of technology's mediating effect on user behavior. Technology is not neutral; it can modulate perception and action and influence ethical practice at individual and social levels. Interaction design therefore goes beyond functional solutions; it carries the responsibility of shaping social behavior

and moral choices. Designers should ask how design can guide users toward socially ethical action and avoid misuse or harms.

Consider smart transportation. Designers should reduce accidents and improve efficiency while protecting safety and privacy. Responsibility ethics demands attention not only to flow optimization but also to preventing privacy invasion or new inequalities. Designers should assume responsibility by providing transparency, user choice, and data protection.

Second, the framework asks designers to consider social impact and anticipate risks. Technology can affect social structures and values—for example, through social-media recommendation algorithms that shape political views and consumption, thereby influencing public opinion. Responsibility ethics requires proactive measures during design to prevent negative social effects and to ensure alignment with the public interest.

Third, it emphasizes anticipatory responsibility. Unlike traditional, retrospective ethics, Verbeek urges designers to take responsibility for future impacts by integrating prevention into early-stage design. In interaction design, this means foreseeing deep effects on behavior and preempting dilemmas such as data misuse and privacy violations.

Finally, responsibility ethics stresses *shared* responsibility among stakeholders, users, designers, developers, regulators, and others. Collective responsibility ensures that

technology not only provides convenience to individuals but also yields long-term social benefits.

6.4.2 Responsibility Ethics and User Behavior

In interaction design, the interaction between responsibility ethics and user behavior means that design influences behavior while embedded values regulate it at the behavioral level. Because technology affects behavior, cognition, and social relations, responsibility ethics must address not only functionality but also ethical guidance and constraint. Interaction is bidirectional: technology shapes behavior, and behavioral feedback reshapes technology. Understanding this reciprocity is vital to socially responsible interaction design.

Responsibility ethics modulates behavior and fosters pro-social conduct. Built-in ethical guidance and social-responsibility features can steer users toward moral choices. Health apps, for example, may use rewards to encourage healthy routines or provide energy-saving prompts to support environmental stewardship. Through encouragement, rewards, and reminders, design aligns behavior with social responsibility.

Data use and privacy are central. Because data is a core resource, responsibility ethics requires privacy protection and avoidance of filter bubbles in recommender systems. Designers must prevent misuse, ensure diversity of exposure, and preserve users' autonomy and choice, key to aligning interactional outcomes with responsibility ethics.

User autonomy versus technological guidance is another crucial issue. Responsibility ethics aims to preserve autonomy under mediation. Smart devices and services should give users control over scope, functionality, and data practices, avoiding overreach and ensuring independence and freedom of decision. Clear settings, transparent terms, and flexible controls enable autonomy alongside convenience.

At the same time, designers must anticipate unintended consequences of mediation. Overreliance on recommendations can narrow decision freedom and produce one-dimensional consumption or value orientations. Responsibility ethics calls for reflection on design boundaries and for safeguarding plural needs and autonomous decisions.

Behavioral feedback also shapes responsibility ethics in practice. Smart-home systems, for example, iteratively improve by learning from use, aligning services to users' patterns. This reciprocity advances responsibility ethics within technological evolution.

6.4.3 Responsibility-Ethics Design for the Future

With rapid advances in AI, big data, and IoT, responsibility ethics in interaction design faces increasingly complex challenges. Future-oriented responsibility-ethics design must not only address current issues but also anticipate risks and social impacts. Verbeek's philosophy provides guidance on internalizing ethics by design, preventing misuse, preserving autonomy, and upholding social justice.

Ethical foresight. Designers should consider long-term impacts, not just immediate applications. They need the ability to anticipate issues such as job displacement and decision transparency. Ethical frameworks, technical assessments, and social-impact analyses should be integrated early to identify risks and devise countermeasures.

Transparency and explainability. Many intelligent systems operate as "black boxes," which threatens trust. Future design should make decision processes transparent and allow user participation. In recommenders, for instance, users should understand how items are selected and be able to adjust settings-improving trust and reducing unfair outcomes.

User empowerment. Designers must ensure that users retain decision-making power under technological guidance. Provide options and controls for personalization rather than imposing standardized prescriptions (e.g., in digital health). This both protects autonomy and increases satisfaction.

Social justice and fairness. To prevent technology from exacerbating inequality, through digital divides or algorithmic bias, designers must consider societal effects and ensure non-discriminatory applications (e.g., fairness across races and genders in face recognition). Future responsibility-ethics design will prioritize broad accessibility so that all users benefit equally.

Environmental sustainability. Designers should account for resource and energy impacts, pursuing low-carbon, energy-efficient, sustainable solutions. Lifecycle thinking, repairability, recyclability should guide green technology and reduce e-waste.

In short, future responsibility-ethics design must solve today's problems and anticipate tomorrow's. By increasing transparency, empowering users, and promoting fairness and sustainability, designers can provide effective ethical guidance for technological applications. As technology evolves, responsibility-ethics design will continue to develop, ensuring that technology serves human well-being, social justice, and environmental sustainability, and guiding society toward a more equitable, transparent, and responsible future.

6.5 Ethical Dilemmas and Challenges in Interaction Design

6.5.1 User Privacy and Data Ethics

With the advent of the digital era, data has become a critical asset of the information society. In interaction design in particular, the collection, storage, and processing of data have increasingly moved to the core of technological development. Yet as big data, artificial intelligence, and the Internet of Things are adopted, issues of user privacy and data ethics have come to the fore, becoming a major ethical dilemma and challenge for interaction design.

The most prominent issue is the infringement of user privacy. With the widespread use of social media, mobile apps, and smart devices, vast amounts of personal information are collected and analyzed. Beyond basic identity information, this may include behavioral data, interests, geolocation, and even sensitive indicators such as emotional states. While data collection in interaction design often aims to improve user experience or provide personalization, protecting privacy and information security during collection and use is a major challenge for designers.

For example, smart devices or social platforms often track users' online behavior or locations to optimize services, but they may not fully inform users about the scope and purpose of data use. Users may unknowingly hand over large volumes of private data to platforms, resulting in privacy violations. Verbeek's notion of technological mediation emphasizes technology's *implicit* regulative effects: technology does more than perform explicit functions, it subtly shapes behavior and values through design and functionality. Privacy risks are precisely such a product of implicit mediation. Designers should therefore uphold the principle of transparency in data practices and ensure that users know about and can control how their data is used.

A second serious concern is data misuse and improper use. In many cases, data serves not only to enhance user experience but is also commercialized for advertising, marketing, or even political influence. Some platforms, for instance, leverage behavioral data for targeted ads or analyze emotional cues to sway purchasing choices or voting behavior. Such commercial exploitation not only infringes privacy, it also

undermines users' autonomy in decision making. More troubling still, improper data use can harm society, for example, by manufacturing filter bubbles, reinforcing bias, or fomenting polarization.

Accordingly, a responsibility-ethics approach to interaction design requires that data collection and processing pursue ethically sound purposes and respect users' rights to be informed and to choose. Designers should address privacy and compliance at the design stage, adopting encryption, anonymization, and data minimization, while making data use transparent and lawful through appropriate interface and policy design.

User control over data use is another core element of data ethics. A responsibility framework stresses that users should control their own data: they should be able to know at any time how data is collected, stored, and used, and retain the right to consent or withdraw authorization. In interaction design, this means providing simple, usable privacy settings that let users view and modify permissions at any time and decide what to collect and share. In smart-home systems, for instance, users should be able to easily choose whether devices may collect health data or household activity data and clearly understand the purposes and scope of such use.

Data security is equally indispensable. Whether personal or sensitive, data is vulnerable to leakage, theft, or malicious attack during collection and storage. Designers should therefore ensure secure storage and transmission-using state-of-the-art encryption and protections to prevent unauthorized access in transit or at rest. Improving data security

not only protects privacy but also builds trust in technological products, facilitating wider adoption and use.

6.5.2 Moral Materialization and the Problem of Technological Control

Moral materialization and technological control form a complex ethical problem in interaction design, made more acute by the rapid development of AI, big data, and automation. Verbeek's philosophy holds that technology is not merely a tool; through design it mediates and shapes human behavior, cognition, and social interaction. Moral materialization refers to the internalization of moral norms into the functions and structures of technical products, which then implicitly guide and regulate behavior. The potential problem in this process is that technological control may silently constrain user autonomy and significantly affect conduct.

The first manifestation is technology's *implicit* regulation of user behavior. AI- and algorithm-driven systems collect user data (behavioral patterns, interests, social interactions) to deliver personalized recommendations and customized services. While this improves experience, it also subtly narrows users' options and influences decisions. Recommender systems, for example, push personalized content inferred from past behavior. Such pushes may reinforce existing views or interests and generate "filter bubbles" or "echo chambers." This control is not a choice users actively make; the system infers and serves content likely to capture attention. In this way, behavior and cognition are quietly steered, potentially shrinking the space for free choice and limiting autonomous decision making.

A second manifestation lies in the shaping of social structure and power relations. As AI and big data proliferate, technology mediates not only individual behavior but also social dynamics. Social media platforms, for instance, filter and push content algorithmically, determining which information circulates and which voices are marginalized. This form of technological control consolidates platform power and may profoundly affect public information, opinion, and social cognition, exacerbating inequality or political polarization. When decision processes lack transparency, users may not realize they are being steered and may have no effective means of resistance.

The tension between moral materialization and control is especially salient in artistic creation, particularly when AI participates. AI can generate music, painting, and poetry, blurring the subject of creation. When AI's generative processes displace an artist's independent creation, authorship becomes unclear. Trained on large datasets of prior works, AI can simulate or even surpass stylistic features. Creation is no longer the direct expression of an artist's emotion and intent; it becomes technologically led. Lacking the creator's subjective investment, AI works may meet formal artistic standards yet lack the human expressive depth and socio-historical context-raising concerns about the *materialization* and *control* of art. As such works circulate, questions of meaning and value follow.

This also raises questions of authorship and responsibility. In traditional practice, rights belong to the artist; with AI-generated work, the creator is not clearly identifiable. If AI works are widely disseminated and commercialized, who holds copyright and who

bears responsibility-the system developer or the user who prompted it? Beyond legal issues, this triggers ethical debate about responsibility in artistic creation. Moreover, AI-generated content can intensify commercialization and platform control: companies profit from AI works while human contribution behind the process may be ignored or displaced, threatening fairness in the art market as well as the independence and diversity of artistic creation.

In sum, in interaction design the problem of moral materialization and technological control appears as the implicit steering of user behavior and the shaping of social conduct and structures. Designers must carefully balance technological guidance and user autonomy, ensuring that moral materialization expands choice rather than oversteers free decision making. In AIGC-based art especially, clarifying authorship and preventing technology from *materializing* and constraining the freedom of artistic expression are pressing ethical questions that future designers will need to address in depth.

Chapter 7: Conclusion and Outlook

7.1 Research Summary

7.1.1 Main Research Findings

This dissertation takes AIGC (Artificial Intelligence Generated Content) technology as its primary research object and, from the perspective of the philosophy of technology, explores the mechanisms by which human subjectivity is reconstructed in the process of technological adoption in the AIGC era. On this basis, it proposes an integrated "technological-ethical analytical framework for the reconstruction of subjectivity in AIGC." This framework constitutes the central theoretical contribution of the study. It places Peter-Paul Verbeek's philosophy of technology at its core, while incorporating insights from Don Ihde's postphenomenology, Shannon Vallor's ethics of technological virtues, and Yuk Hui's theory of cosmotechnics, thereby redefining the relationship between technology and subjectivity across philosophical, ethical, and cultural dimensions. The framework not only reveals the profound impact of AIGC on human behavior, cognition, and ethics but also provides a new analytical path for understanding the transformation of subjectivity in the technological age.

The dissertation begins with Verbeek's theories of technological mediation and moral materialization to demonstrate that AIGC is not a neutral tool but an active participant that shapes human moral perception and behavioral patterns. Technology, through its interaction with human beings, generates new ethical intentionalities. As a result, human agency is no longer an independent expression of will but becomes a co-

constructed subjectivity embedded within technological mediation. Building upon this idea, the study introduces an analytical pathway of "technological mediation-ethical formation-subjective reconstruction," showing that the formation of subjectivity in the AIGC era is a technical, relational, and contextual process.

Next, by integrating Vallor's ethics of technological virtues and Ihde's postphenomenological theory, the dissertation further analyzes how AIGC regulates and reshapes human virtues and behavioral structures. In the interaction between humans and algorithmic systems, capacities such as judgment, self-control, and empathy are continuously shaped and challenged by technological contexts. Accordingly, this study proposes a three-dimensional model of subjectivity reconstruction-embodiment, action, and virtue-arguing that technology alters human experience through embodied perception, influences moral practice through behavioral regulation, and ultimately reshapes ethical character and value orientation at the level of virtue. This model breaks through the traditional ethical assumption of technology as external to morality, emphasizing instead that moral formation has become a dynamic process jointly constituted by humans and technology.

The research then incorporates Yuk Hui's cosmotechnics to expand the cultural dimension of AIGC ethics. Hui contends that technology is always embedded within a cosmological and cultural order and that there is no singular, universal rationality of technology. Building on this insight, the dissertation interprets the acceptance of AIGC as a process of cross-cultural technological materialization, proposing a global

perspective of technological diversity and ethical co-formation. This approach recognizes that ethical standards and notions of responsibility differ across cultures and should be regarded as equal and complementary. AIGC responsibility ethics, therefore, should not merely extend Western rationalist traditions but rather serve as a site for dialogue among multiple cosmotechnical systems. Through this intercultural framework, the study highlights the contextuality, plurality, and openness of technological ethics and underscores the necessity of constructing a globally inclusive ethical responsibility system.

At the level of responsibility ethics, the dissertation integrates Verbeek's concept of experimental ethics with Hans Jonas's principle of responsibility, constructing a threefold structure of anticipatory responsibility, materialized responsibility, and systemic responsibility. It argues that the core of AIGC ethics lies not in retrospective accountability but in the proactive embedding of moral responsibility during the design phase. Ethical responsibility is not limited to individual moral action but should operate within the broader ethical constraints of technical systems and networks. By drawing on Luciano Floridi's information ethics, the study further suggests that responsibility should be distributed dynamically throughout the technological system, forming a multilayered ethical network encompassing individuals, institutions, and algorithmic systems. This framework expands the scope of technological ethics and provides a theoretical foundation for the governance of AIGC.

In summary, through the reinterpretation of Verbeek's philosophy of technology and the integration of diverse theoretical traditions, this dissertation proposes a comprehensive framework that combines theoretical innovation with practical applicability.

First, at the level of technological formation, the framework reveals that the social adoption of AIGC technology is not a linear or passive process of diffusion but a generative interaction in which humans and technology mutually shape one another. AIGC, through its algorithmic logic, data systems, and interface design, participates in social practices where technological structures embody both functional intentions and social values. Human engagement and feedback continually reshape the meaning of technology, making AIGC a key medium for producing social experience and public meaning. In this sense, AIGC adoption is understood as a dynamic technological-social symbiosis, wherein the logic of technological dissemination and the ethical structure of society influence one another, forming new modes of cognition and behavior.

Second, at the level of subjective reconstruction, the framework illustrates how AIGC profoundly reconfigures human subjectivity in behavioral, cognitive, and moral dimensions. Technology is no longer an external condition for moral action but an internal force that shapes ethical perception and judgment. Through its continuous interaction with users, AIGC reorganizes human intentionality and behavioral logic, making subjectivity increasingly relational and contextual. By integrating Verbeek's theory of moral materialization and Vallor's technomoral virtues, the dissertation

develops the embodiment-action-virtue model, showing how AIGC reshapes human experience at the perceptual level, guides behavior at the practical level, and generates new ethical character and social responsibility at the level of virtue. In this way, agency becomes a co-produced outcome of human and technological interaction rather than an autonomous force external to technology.

Finally, at the level of ethical embedding and design, the framework argues that responsibility ethics should be incorporated from the earliest stages of technological development, making ethical principles intrinsic to AIGC systems. Building on Verbeek's experimental ethics and Jonas's principle of responsibility, the study constructs a multidimensional structure of anticipatory, materialized, and systemic responsibility, emphasizing that ethical responsibility should permeate the entire process of algorithm design, data governance, and user interaction. Drawing from Floridi's information ethics, the framework further introduces the concept of distributed responsibility, suggesting that in the complex network of AIGC, ethical responsibility must be shared among individuals, institutions, and technological systems. Through this configuration, technological design becomes not merely a process of functional optimization but a site for the joint formation of ethics and responsibility, offering a normative foundation for the sustainable development and governance of AIGC.

Overall, this framework deepens the philosophical understanding of AIGC's technological adoption and the reconstruction of human subjectivity while providing a systematic theoretical foundation and methodological approach for AI ethics and

governance. It demonstrates that in the AIGC era, the human-technology relationship has evolved from one of use to one of coexistence, and that ethics is no longer an external constraint but an intrinsic dimension of technological existence itself. The framework thus opens a new direction for applying the philosophy of technology to artificial intelligence and provides a theoretical and practical guide for the ethical construction of future technological societies.

7.1.2 Contributions of Verbeek's Technological Philosophy

Verbeek's philosophy of technology provides the central theoretical foundation for this study. Beginning with the concept of technological mediation, Verbeek breaks through the traditional dichotomy in the philosophy of technology between instrumentalism and determinism, proposing that technology is not merely an extension of human intention but a mediating force that actively shapes human perception, behavior, and moral judgment. By conceptualizing technology as a mediator, Verbeek reconstructs the relationships between humans and technology, and between technology and the world, revealing how technology influences subjectivity and ethical formation at the practical level. This shift transforms the philosophy of technology from an ontological inquiry into "what technology is" to a practical analysis of "how technology acts" and "how technology shapes human beings," thereby establishing the methodological foundation for ethical research in the AIGC era.

Verbeek's greatest contribution lies in elevating technology from a passive instrument to an entity with ethical participation, opening the path toward the study of moral materialization. Technology, in this view, is no longer a mere background to human action but a co-constitutor of moral behavior: algorithms, interfaces, and physical structures can subtly mediate human choices and value judgments. This perspective is particularly illuminating for autonomous generative systems such as AIGC, as it provides a philosophical framework for understanding how artificial intelligence can influence ethical practice even in the absence of direct human intention. Through Verbeek's lens, the ethical character of AIGC is not externally assigned by humans but emerges dynamically through a continuous cycle of design, use, and reflection.

However, Verbeek's theory also has clear limitations. First, it tends to emphasize the mediating capacity of technology while overlooking the structural powers and institutional logics that underpin it. In Verbeek's framework, the relationship between humans and technology is described as one of mutual mediation and co-constitution, but he seldom addresses how capital, politics, and cultural systems condition technological development. As a result, his analysis appears somewhat depoliticized at the macro level. Second, although Verbeek's notion of embedding ethics within design transcends the boundaries of traditional moral agency, it remains focused on micro-level, practice-oriented ethics, with limited attention to systemic risk, global governance, or cross-cultural variation. This makes his framework somewhat inadequate when applied to technologies such as AIGC, whose influence extends across global, political, and cultural domains.

To address these limitations, this study integrates complementary perspectives from several key thinkers. Don Ihde's postphenomenology enriches Verbeek's framework by focusing on embodied experience, revealing through the triadic relation of embodiment, hermeneutics, and background how technology reshapes human perception of the world. This provides a phenomenological foundation for analyzing the interaction between AIGC and human experience. Shannon Vallor's theory of technomoral virtues expands Verbeek's framework on the ethical level by emphasizing that humans must cultivate virtues such as self-control, humility, and practical wisdom within technologically mediated environments to sustain moral growth. Her perspective compensates for Verbeek's neglect of inner moral cultivation, shifting the discussion from external regulation to internal moral development. At the same time, Yuk Hui's theory of cosmotechnics introduces cultural and global dimensions into Verbeek's philosophy. Hui argues that technology is never a universal rational construct but is always co-generated with each culture's cosmological and ethical order. This insight challenges the implicit Western-centrism in Verbeek's theory and provides a cross-cultural interpretive framework for addressing the ethical and responsibility issues surrounding AIGC.

By integrating Verbeek's theories of technological mediation and moral materialization with Ihde's embodiment, Vallor's technomoral ethics, and Hui's cosmotechnics, this study achieves a multi-level theoretical synthesis. At the micro level, technology

mediates human perception and action, thereby reconstructing subjectivity. At the meso level, morality emerges through the interaction between virtue cultivation and technological engagement. At the macro level, technological responsibility is situated within a global cultural context, forming an open and pluralistic ethical landscape. This integration transforms Verbeek's practice-oriented theory into a systematic ethical framework, providing a new theoretical foundation for the philosophy of technology in the age of artificial intelligence.

In sum, Verbeek's contribution lies in offering a foundational paradigm for understanding the ethical agency of technology, while his limitations motivate this study's incorporation of multiple theoretical resources to extend his work from technological mediation to a broader conception of technological-ethical co-constitution. This critical inheritance and interdisciplinary integration not only deepen the interpretive scope of Verbeek's thought but also establish a more open and multidimensional theoretical foundation for ethical reflection in the AIGC era.

7.1.3 Innovations and Applications of Research Methods

This study achieves methodological innovation through a multidimensional and integrative approach, designed to address the complex philosophical and ethical challenges posed by AIGC technology. Unlike traditional studies in technology ethics that often rely on normative analysis or case-based discussions, this research establishes

a systematic transformation from philosophical reflection to theoretical integration, contextual analysis, and normative formulation, thereby creating a research model that combines interpretive depth with practical orientation. This methodological innovation not only connects the philosophy of technology with real-world technological applications but also provides a replicable paradigm for future studies in artificial intelligence ethics.

First, the study achieves innovation through cross-theoretical integration at the conceptual and methodological levels. Centered on Verbeek's theories of technological mediation and moral materialization, it incorporates Ihde's postphenomenology, Vallor's technomoral virtue ethics, and Hui's cosmotechnics to construct a generative and open analytical framework through theoretical juxtaposition and conceptual reconstruction. This integration is not a simple aggregation of ideas but a philosophical dialogue and translation that enables different theories to operate complementarily within a shared problem domain. Verbeek provides a model for understanding the mediating agency of technology; Ihde elucidates the embodied connection between humans and technological experience; Vallor introduces the dynamic cultivation of virtue within technological environments; and Hui extends the analysis to include cultural and cosmological dimensions. Through this multidimensional synthesis, the study transcends the closure of any single philosophical system and establishes a multi-axis co-constructive research paradigm, ensuring that AIGC research possesses both philosophical depth and a broad ethical and cultural horizon.

Second, at the level of applied methodology, the study proposes a "technology-subject-ethics" triadic analytical framework. Grounded in real-world AIGC applications, it analyzes the interactions among technological design, algorithmic logic, user behavior, and social institutions. By incorporating Verbeek's experimental ethics into the study of AIGC, the research treats technological systems as sites of ethical experimentation, emphasizing that ethics is not an after-the-fact evaluation but a process dynamically generated during design and use. This approach shifts ethical inquiry from abstract normativity to concrete practice, from external observation to internal participation, realizing a "design-as-ethics" research logic. Through the analysis of AIGC's ethical structures in content generation, recommendation algorithms, and data governance, the study demonstrates how technology mediates moral behavior and social relations in practice, thus grounding its theoretical claims in empirical observation.

Third, the research introduces a methodological combination of anticipatory reflection and normative construction. Departing from traditional ethics that focus primarily on retrospective accountability, the study draws upon Hans Jonas's principle of responsibility and Luciano Floridi's information ethics to emphasize the forward-looking and systemic nature of ethical inquiry. By developing a framework of anticipatory responsibility, materialized responsibility, and systemic responsibility, it explores how moral responsibility can be embedded within technological design while also proposing normative principles for AIGC governance. This methodological shift enables a transition from philosophical reflection to institutional design, ensuring that

the research not only possesses interpretive power but also provides actionable guidance for policymaking and ethical design practices.

Finally, the study embodies a methodological orientation that combines philosophical reflection with practical validation. It examines the logic of technological mediation and subjective reconstruction at the theoretical level while simultaneously applying these concepts to real-world AIGC cases such as social media platforms, content generation systems, and automated decision-making technologies. This recursive movement between abstract theorization and concrete analysis demonstrates the explanatory capacity and practical applicability of the proposed framework. By oscillating between conceptual reasoning and empirical verification, the research reveals both the deep structural dynamics of the philosophy of technology and the practical implications for AI ethics governance.

Overall, this study represents a methodological shift from unidirectional analysis to multidimensional interaction, and from static ethical assessment to dynamic ethical generation. It deepens the methodological foundations of the philosophy of technology and establishes a new paradigm for AIGC research that integrates theory and application. The significance of this methodological innovation lies in its ability to bring philosophical inquiry into direct engagement with the ethical design and social practice of artificial intelligence, positioning the philosophy of technology as a vital intellectual force for understanding and shaping the moral foundations of future technological civilizations.

7.2 Limitations of the Study and Future Research Directions

7.2.1 Limitations of the Study

Although this study has achieved a certain degree of theoretical innovation and progress in constructing an analytical framework, it still faces several limitations. These limitations stem both from methodological and material constraints and from the inherent epistemic boundaries that the philosophy of technology encounters when addressing the rapidly evolving realities of AIGC. Reflecting on these limitations not only helps clarify the scope of this research but also provides directions for future deepening and expansion.

First, at the level of theoretical construction, although this dissertation attempts to take Verbeek's philosophy of technology as its core and to integrate the ideas of Ihde, Vallor, and Hui into a triadic "technology-subject-ethics" framework, the depth and systematic coherence of this cross-theoretical synthesis remain limited. On one hand, the differing philosophical contexts and methodological assumptions of these frameworks make it difficult to fully eliminate conceptual tensions during integration. For instance, Verbeek's theory of technological mediation is rooted in phenomenology and pragmatism, whereas Hui's concept of cosmotechnics is grounded in the metaphysical worldview of Eastern philosophy. The two differ fundamentally in their ontological and axiological understandings of technology. Although this study attempts to bridge them

through philosophical dialogue and conceptual translation, there remains room for improvement in achieving greater conceptual consistency and logical coherence.

Second, at the methodological level, the study combines philosophical reflection with case analysis, which provides strong interpretive insight but limited empirical verification. Because AIGC technologies are developing at a rapid pace and their ethical risks evolve dynamically, the selected case studies cannot fully capture the diversity of relevant contexts. For example, the analysis of social media algorithms and content generation platforms reveals important mechanisms of behavioral modulation, yet other crucial domains-such as medical AI, educational AI, and judicial AI-have not been empirically examined in depth. This limitation constrains the generalizability and practical applicability of the research framework, particularly in policy-oriented contexts.

Third, in terms of research scope and data sources, this study relies primarily on publicly available literature, policy documents, and representative application cases, without incorporating sufficient cross-cultural or context-specific empirical data. Since the ethical acceptance of AIGC varies significantly across national and social contexts, relying predominantly on theories and materials developed within Western frameworks may limit the global applicability of the conclusions. In non-Western societies, understandings of technological subjectivity, social responsibility, and ethical norms often differ markedly. Although this research supplements these differences

conceptually through the notion of "technodiversity," it lacks the empirical refinement necessary to substantiate this claim across diverse cultural settings.

Fourth, at the level of normative construction and policy application, the proposed framework of anticipatory responsibility, materialized responsibility, and systemic responsibility offers theoretical insights but still requires further examination regarding its operational feasibility in real governance contexts. AIGC ethics often involves multiple stakeholders-governments, corporations, developers, and users-and the actual distribution and enforcement of responsibility are constrained by institutional, legal, and market dynamics. While the study outlines a structural model of responsibility at the macro level, it does not yet fully explore its practical implementation in areas such as technological regulation, algorithmic auditing, or ethical assessment mechanisms. Consequently, the application of the theoretical results to policy frameworks remains somewhat abstract.

Finally, in terms of temporality and technological evolution, the analysis in this study is based on the current developmental stage of AIGC and its associated ethical characteristics. However, AIGC technology is inherently open-ended and unpredictable. As model architectures, algorithmic mechanisms, and societal applications continue to evolve, the nature and focus of ethical issues are likely to shift significantly. Although the proposed framework possesses a degree of adaptability, its explanatory and predictive capacities will need to be further tested and expanded in future contexts

involving more complex AI ecologies-such as multimodal intelligence, autonomous AI collectives, and systems approaching artificial consciousness.

In summary, the limitations of this study primarily concern the systematic coherence of theoretical integration, the depth of methodological validation, the breadth of data sources, and the practical operability of the proposed framework. These shortcomings do not undermine the theoretical contributions of the research; rather, they highlight the openness and complexity inherent in AIGC ethics and point toward promising directions for future inquiry and refinement.

7.2.2 Future Research Directions

In view of the limitations of this study and the dynamic evolution of AIGC technology, future research should advance along three interrelated dimensions-theoretical deepening, methodological expansion, and practical application-to establish a more inclusive and forward-looking system for philosophical and ethical inquiry into technology.

First, at the level of theoretical deepening, future studies should further explore the mechanisms that integrate the philosophy of technology with artificial intelligence ethics, particularly how to redefine the boundaries of subjectivity, responsibility, and ethical becoming within the rapidly evolving AIGC environment. The present study is grounded primarily in Verbeek's theory of technological mediation and its

postphenomenological lineage. However, given the self-learning, self-evolving, and autonomous creative capacities of generative AI, the traditional "human-technology co-construction" model may no longer be sufficient to capture the active agency of such technologies. Future research could therefore develop theories of post-subjectivity or distributed subjectivity to better describe the dynamic relationships among humans, algorithms, and social institutions within AIGC systems⁹³. Moreover, it will be essential to strengthen dialogue between the philosophy of technology and adjacent disciplines such as Science and Technology Studies (STS), media archaeology, and the philosophy of information. Such interdisciplinary engagement can reveal the underlying power structures and epistemic logics of technological development, thereby enriching the philosophical foundation for understanding AIGC and its impact on human subjectivity.

Second, in terms of methodological expansion, future research should develop interdisciplinary and multi-method approaches. While this study combines philosophical reflection with case analysis, theoretical reasoning alone is insufficient to fully capture the complex social and ethical realities of AIGC. Future work may incorporate empirical methods such as qualitative interviews, surveys, and algorithmic interpretability analyses to systematically examine user behaviors, ethical attitudes, and risk perceptions across different populations in their interactions with AIGC. This

⁹³ Mabile, M. L. (2019). Foucault and the origins of the disciplined subject: Post-subjectivity as a condition for transformation in education. *Transformation in Higher Education*, 4(1), 1-7.

would allow the empirical validation and refinement of theoretical frameworks. In addition, greater attention should be given to ethical auditing and algorithmic ethnography, exploring how empirical tools can trace and evaluate the ethical functions of technological artifacts. By integrating theory with data, the philosophy of technology can evolve from abstract normative reflection to empirically grounded and operational analysis, achieving genuine cross-disciplinary synthesis between philosophy, engineering, and the social sciences.

Third, at the level of practice and policy application, future research should focus on transforming ethical theory into institutional and design-oriented mechanisms. The ethical governance of AIGC requires systematic frameworks spanning technical standards, industry norms, and public policy. Philosophical inquiry should engage directly in this process by proposing concrete pathways for ethical embedding. For example, further exploration of Ethics by Design and Responsible Innovation models could help integrate ethical principles into AIGC development, establishing measurable indicators for algorithmic transparency, data fairness, and accountability traceability. Moreover, future research should consider the cultural and political adaptability of ethical principles across diverse contexts through comparative studies, thereby assessing the feasibility of pluralistic ethical governance and global responsibility frameworks. Only by institutionalizing ethical coordination and technological accountability can a robust system of responsibility for AIGC be effectively realized.

Finally, from a long-term and evolutionary perspective, future studies should reexamine the symbiotic relationship between AIGC and human society. As artificial intelligence moves from instrumental functions toward autonomous generation and cognitive participation, ethical inquiry will extend beyond issues of risk prevention and responsibility allocation to encompass ontological and civilizational concerns. How can humanity sustain its moral and existential agency amid the expanding autonomy of intelligent technologies? Could technology itself become a new form of moral co-being? Addressing these questions requires future research to balance philosophical depth with social breadth, thereby constructing an ethical-philosophical foundation for a posthuman or co-evolutionary future.

In conclusion, future studies on AIGC ethics and the philosophy of technology should continue to deepen the generative logic of technology-subject-ethics at the theoretical level, integrate philosophical reflection with empirical research at the methodological level, and promote the institutional transformation of ethical design and responsible governance at the practical level. Only through such comprehensive advancement can the philosophy of technology truly move from speculative reflection to social practice, offering sustainable intellectual support for humanity's moral future in the age of artificial intelligence.

7.2.3 Technological Ethics and Future Social Challenges

With the rapid evolution and widespread application of AIGC technologies, technological ethics has become one of the most pressing and complex issues for future societies. Artificial intelligence is no longer merely a tool serving human intentions; it is increasingly emerging as a structural force shaping social systems, deeply influencing politics, economics, culture, and even individual cognition. The ethical challenges posed by AIGC extend far beyond questions of technological risk management—they concern the reconfiguration of social order and the transformation of human civilization itself. In the face of this profound change, both the philosophy of technology and ethics must transcend traditional normative frameworks and develop a new ethical paradigm capable of addressing technological autonomy and social complexity.

First, the primary challenge for technological ethics lies in the blurring of subject boundaries and the complexity of responsibility attribution. As AIGC systems acquire the capacities to generate, evaluate, and make decisions, the human-centered ethical frameworks that once dominated moral thinking are being fundamentally destabilized. The moral subject is no longer a singular human agent but a dynamic network composed of humans, algorithms, data, and institutions. This multi-agent ethical configuration renders questions such as "who is responsible" and "who can judge" increasingly indeterminate. Future societies may no longer rely on individual moral judgment as their ethical foundation but on distributed governance and collaborative ethical mechanisms mediated by algorithms. The central challenge, therefore, will be how to preserve human value centrality and moral awareness within these complex networked systems.

Second, AIGC technologies exacerbate structural inequalities in knowledge, power, and social justice. As algorithmic models and computational resources become concentrated in the hands of a few global tech corporations, the production and control of technology are reshaping the global power hierarchy. Information asymmetry and data monopolies erode individual autonomy and threaten the rational foundations of the public sphere. Algorithmic bias, covert manipulation, and ideological filtering are transforming public discourse, allowing technological logic to silently dominate social life. Hence, the ethical question is no longer only how to regulate technology but also how to prevent technology from becoming a new mode of domination, avoiding the emergence of an "algorithmic society." Ethical research must thus move from an analysis of individual responsibility to structural critique, and from the assumption of technological neutrality toward an inquiry into power relations and social justice.

Third, the continued advancement of AIGC has triggered an ontological and existential ethical crisis. As artificial intelligence begins to exhibit human-like capacities in creativity, reasoning, and even moral judgment, humanity's sense of uniqueness, creativity, and value foundation faces unprecedented challenges. Technology no longer merely alters modes of labor; it subtly reshapes human perception, emotion, and moral experience. The dissolution of the human-machine boundary undermines the philosophical foundation of human exceptionalism. The question for future ethics is no longer "how humans should use technology," but rather "how humans and technology

can coexist." This calls for the establishment of a post-humanist or ethics of coexistence framework, one that regards humans, technologies, and nature as co-evolving entities, thereby reconstructing the very foundation of ethical thought.

Furthermore, technological ethics faces the challenge of globalization and cultural diversity. The worldwide diffusion of AIGC has rendered ethical questions transnational, yet different cultures, religions, and political systems hold divergent understandings of moral norms. In some cultures, data sharing is seen as a civic responsibility; in others, individual privacy holds inviolable moral significance. Future ethical inquiry must therefore move beyond a singular Western rationalist model and develop mechanisms for pluralistic dialogue and cross-cultural negotiation, allowing the notions of "responsibility" and "justice" to coexist in both global consensus and cultural diversity. Yuk Hui's concept of cosmotechnics provides critical insight here: ethics is not a universal abstraction but a form of life rooted in each culture's cosmological understanding of technology. Future technological ethics must therefore strike a new balance between global diversity and ethical universality.

Finally, the ultimate challenge for technological ethics lies in preserving humanity's moral imagination of the future. As artificial intelligence continues to evolve, ethical risks and technological uncertainties will become structural features of society. In this context, ethics must not remain merely defensive or regulatory; it must evolve into a creative and generative force guiding humanity toward the future. Verbeek's notion of experimental ethics offers a crucial insight: ethics should not passively respond to

technology after its emergence but should intervene proactively at the design stage, co-shaping the moral direction of future societies. Ethical thinking must thus become open and generative, capable of discovering new modes of coexistence amid uncertainty and sustaining the moral vitality of human civilization.

In conclusion, the ethics of technology in the AIGC era is no longer a framework for preventing risk but a fundamental reflection on the symbiosis between humans and technology. The ethical challenges of future societies call for a new balance among subjectivity, social justice, cultural diversity, and existential meaning, ensuring that technology ceases to be an external force of control and becomes an intrinsic medium for human value creation and shared destiny. This is not only the mission of ethics but also humanity's philosophical responsibility and self-examination in confronting the civilization of the technological future.

7.3 Conclusion

The rise of AIGC (Artificial Intelligence-Generated Content) technology marks humanity's entry into a new epoch characterized by algorithmic mediation and generative production. Technology is no longer a mere instrument but has become a deep structural force shaping human thought, behavior, and moral frameworks. From the perspective of the philosophy of technology, this study undertakes a systematic exploration of the triadic relationship among technology, subjectivity, and ethics,

aiming to construct a future-oriented theoretical framework across three dimensions: the social acceptance of AIGC, the reconstruction of human subjectivity, and the formation of responsibility ethics. Through an integrative and critical interpretation of the ideas of Peter-Paul Verbeek, Don Ihde, Shannon Vallor, and Yuk Hui, the dissertation reveals the mechanisms of interaction between human subjectivity and technological mediation in the AIGC era, and proposes an ethical-analytical approach that is both generative and applicable.

The core contribution of this study lies in the reinterpretation of Verbeek's theories of technological mediation and moral materialization, leading to the formulation of a "technological-ethical analytical framework for the reconstruction of AIGC subjectivity." This framework demonstrates that subjectivity is no longer an autonomous existence external to technology but a dynamic process continually generated through technological mediation and regulation. AIGC does not merely modulate human behavior and perception; it also profoundly participates in the formation of moral judgment and value orientation, making technology itself a condition for ethical becoming. Consequently, the paradigm of the philosophy of technology shifts from asking "How do humans use technology?" to "How does technology co-shape the human?", thereby achieving a philosophical renewal of subjectivity theory in the age of artificial intelligence.

At the same time, the dissertation argues that the ethical challenges of AIGC extend

beyond individual moral risks to encompass systemic and structural reconstructions of responsibility. By introducing the analytical framework of anticipatory responsibility, materialized responsibility, and systemic responsibility, the study illustrates the multi-layered and distributed logic of responsibility in the AIGC era. Responsibility is no longer confined to an individual agent but emerges dynamically and is continuously redistributed across technological systems, design processes, and social networks. This framework not only provides a theoretical foundation for AI governance but also offers philosophical support for the institutionalization and design practices of technological ethics.

More importantly, by incorporating Yuk Hui's concept of cosmotechnics, this research expands the ethical inquiry of AIGC into a global philosophical horizon, emphasizing the intrinsic connection between technological development and cultural diversity. Technology has never been the outcome of a single rational logic but represents the worldview practices of distinct civilizations. In the global dissemination of AIGC, the formation of ethical consensus should not be centered on any one culture but should emerge through dialogue and mutual construction among multiple cosmologies. This cross-cultural philosophical perspective provides an intellectual foundation for the future creation of an AI civilization grounded in ethical coexistence, pluralism, and shared governance.

Nevertheless, the study acknowledges that the ethical challenges brought by AIGC are

far from exhausted. As technological autonomy continues to evolve, the relationship between humans and intelligent systems will keep transforming, and new moral dilemmas and social risks will continue to emerge. Future research in the philosophy of technology must build stronger bridges between theory and empiricism, and between normative principles and practical implementation, promoting the institutional realization of ethical reflection. At the same time, philosophy must maintain an open attitude toward the future of technology-remaining vigilant against the risks of technological alienation while also recognizing technology's potential as an extension of human values and creative capacity.

In summary, AIGC technology not only challenges traditional human-centered ethics but also offers philosophy an opportunity to rethink the meaning of being human. The task of the philosophy of technology is not merely to ask "What is technology?" but to confront the deeper question: "How can humanity continue to be human within technology?" In the civilization to come, only by maintaining a balance between reflection and creation, and by reconstructing an ethical order between responsibility and freedom, can humanity sustain its moral meaning in symbiosis with intelligent technology and open a path toward a new ethical epoch.