

Theoretical Logic and Inner Mechanism of the Integration of Culture and Technology

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Manuscript received June 4, 2025; accepted August 24, 2025; published September 18, 2025.

Abstract—A prosperous culture leads to a thriving nation, and a strong culture empowers a resilient people. Culture is the soul of a country and a nation, embodying soft power. When science and technology flourish, the nation thrives; when science and technology are strong, the country is powerful. Science and technology constitute the primary productive force and are a vital force driving social progress. Both culture and science and technology are essential components of human civilization. Despite the differences between Chinese and Western cultures, as well as distinctions between ancient and modern times in terms of culture and science and technology, the two interact and influence each other, fusing and promoting each other's development. Culture endows science and technology with spirit, wisdom, and beauty, while science and technology endows culture with form, energy, and power. In future development, greater emphasis should be placed on the integration of culture and science and technology, leveraging their respective strengths to drive the continuous progress of human civilization. At the same time, research on the interaction mechanism between culture and science and technology should be strengthened to provide theoretical support and practical guidance for the country's cultural prosperity and technological innovation.

Keywords—culture, technology, digitalization, innovation

I. INTRODUCTION

Both culture and technology are the achievements of human beings in understanding and transforming the objective world. Culture focuses on society, aiming to cultivate and enlighten people, and generally falls within the scope of social sciences; while technology targets nature, striving to harness and control it through skills, and belongs to the realm of natural sciences. Culture and technology together constitute the knowledge system of humanity. Although they belong to different disciplines, culture and technology share the same origin and flow, and are essentially two sides of the same coin of human knowledge. In modern society, technology permeates every aspect of human life and has become the medium through which culture exists. Culture and technology are intertwined and coexist. The integration of culture and technology is a poetic transformation where both converge towards each other.

II. THE KNOWLEDGE-BASED CORRELATION BETWEEN TECHNOLOGY AND CULTURE

A. The Knowledge Base of Technology and Culture

Knowledge, the summation of human exploration of the world, is the driving force for civilizational progress, embodying truth, goodness, and beauty. Both technology and culture are founded upon the bedrock of knowledge. Knowledge can be divided into natural scientific knowledge

and humanities and social scientific knowledge. Natural scientific knowledge serves as the foundation for technological development, while humanities and social scientific knowledge is closely linked to culture. In modern society, science and technology are integrated and mutually reinforcing, each indispensable to the other.

B. The Exploration of the Beauty of Technology and the Truth of Culture

The truth of technology is unquestionable, yet its beauty is often overlooked. Beauty is often seen as a subjective experience, seemingly at odds with the objectivity of science. However, the objectivity of technology is relative; for instance, Newtonian mechanics applies only at conventional scales, while at cosmic scales, objects obey Einstein's relativity, and at microscopic scales, particle motion follows quantum mechanics. Technology embodies beauty not only in its applications but also in its development process. The beauty of science lies in its thinking, as exemplified by Ockham's Razor, which pursues the beauty of simplicity, and Copernicus's heliocentric theory, which describes celestial motion in a more concise manner. The beauty of technology lies in creation, with inventions like airplanes, submarines, and microscopes not only expanding the realms of aesthetic exploration but also exhibiting beauty in their creations themselves.

The beauty of culture is readily apparent, yet its truth is often hidden. When admiring the Mogao Caves or appreciating poetry, we directly perceive beauty. However, when savoring the pastoral scenes described by Tao Yuanming, we often overlook the poet's disgust with the corrupt officialdom of his time; when marveling at Fan Zhongyan's compassionate spirit, we often fail to see the social reality of his dynasty mired in national crises. Marx believed that the culture of a given era reflects the social relations of that era. Culture brings us aesthetic pleasure, which is sensual and subjective; yet, the social relations it reflects are objective and real.

C. Technology and Culture Jointly Drive the Progress of Human Civilization

Technology and culture share a common goal: the pursuit of goodness. Human civilization is divided into material and spiritual civilizations, both of which are driven forward by technology and culture. As the primary productive force, technology propels changes in production tools, expands humanity's ability to develop and utilize nature, enhances material production levels, and propels society from primitive and agricultural stages to industrial and, in the 21st century, post-industrial societies. Culture, on the other hand, showcases the achievements of spiritual civilization, from

Aristotle to Hobbes, from Laozi to the contemporary Chinese concept of a community with a shared future for mankind, guiding human society towards more equal, open, and fair development. Fairness, justice, mutual benefit, and win-win cooperation have replaced hierarchical exploitation, marking the progress of human civilization jointly promoted by technology and culture.

III. THE COMPLEMENTARITY OF VALUE RATIONALITY AND INSTRUMENTAL RATIONALITY

A. Dual Dimensions of Rationality: Instrumental Rationality and Value Rationality

Rationality, the unique human capacity for judgment, reasoning, and cognition, distinguishes humans from animals. Marx pointed out, *"The worst architect, from the very outset, differs from the best of bees in that, before he builds a cell of wax, he has already constructed it in his head [1]."* Western sociologist Max Weber distinguished between instrumental rationality and value rationality. Instrumental rationality, or calculative or technical rationality, is manifested in capitalist society where capitalists utilize technology to enhance productivity, reduce costs, and obtain profits. The purpose of technological development is capital appreciation. Value rationality, on the other hand, acts based on the intrinsic value of the action itself, such as rescuing a drowning child out of moral value or attending a musical for artistic enjoyment. Weber defined it as *"the pure belief, conscious of its unconditional intrinsic value, in a specific conduct—whether ethical, aesthetic, religious, or any other interpretation—regardless of whether it achieves success [2]."*

B. Cultural Development and the Progress of Value Rationality

The development of culture entails the development of value rationality. Cultural progress is accompanied by advancements in value rationality. The Western Enlightenment was not only a cultural movement but also an ideological revolution that reconstructed values, liberating humanity and reaffirming human rationality, freedom, rights, and values. China's New Culture Movement facilitated the modern transformation of value rationality, opposing feudal ethics and advocating freedom, science, and democracy, laying the foundation for the popularization of values such as independence, autonomy, fairness, and justice.

C. Complementarity and Guidance between Technological Rationality and Value Rationality

Technological rationality is guided by value rationality. Human behavior is purposeful, with goals determined through value identification and achieved through the use of tools. Value rationality directs technological rationality. Firstly, value rationality ensures that technology is used for good; without guidance, technology can bring both blessings and disasters, such as atomic energy, which can be converted into electricity or become a nuclear weapon. Secondly, the selection of technological research topics and development directions are influenced by social needs. For example, China focuses on solving choke point problems, developing high-tech and cutting-edge technologies, and achieving

technological autonomy, which aligns with the cultural value of independence and autonomy.

The development of modern Western technology, guided by the cultural values of capitalist liberalism, has triggered a crisis of modernity, manifested as human alienation. Marx pointed out that under capitalism, production tools and large machinery have increased productivity, but workers have become appendages on the production line. Products are no longer produced to meet life's needs but for market exchange and profit, with relations between things replacing human relations, and humans becoming means to realize the value of things. Another crisis is the ecological crisis. Ecologists argue that technology in capitalist society aims to conquer and control nature, leading to unrestrained exploitation, environmental damage, disruption of the biological chain, and the greenhouse effect. Capitalist technological culture, oriented towards control and efficiency, cannot resolve the contradictions between humans, between humans and things, and between humans and nature. Civilizational development requires a post-capitalist technological culture.

IV. CULTURE ENDOWS TECHNOLOGY WITH SOUL, WISDOM, AND BEAUTY

Culture brings technology into our lives and enables it to better benefit humanity. Amidst the accelerating evolution of profound changes unseen in the world in the past century, culture is increasingly becoming a vital source of national cohesion and creativity, as well as a significant factor in the competition of comprehensive national strength. As a form of soft power, culture's influence on a country's economic, military, and technological hard power is deepening. For technology, culture provides rich content resources, vast demands, and application scenarios, endowing technology with soul, wisdom, and beauty, and thereby promoting innovative development and widespread application of technology.

A. Culture Instills Soul into Technology

This is embodied in the fusion of value rationality and instrumental rationality. Culture provides spiritual strength for technological development, inspiring scientists and technologists to explore the unknown, challenge traditions, and solve problems with innovative thinking. For example, the spiritual force behind China's remarkable achievement of *"Two Bombs and One Satellite"* within just a decade. At the same time, culture provides value guidance for technological development, ensuring that technology is used for good, avoiding environmental crises as described in *Silent Spring*, emphasizing humanistic care and social responsibility, guiding the direction of technological development to benefit humanity, and promoting social harmony and progress.

B. Culture Endows Technology with Intelligence

Culture, as a spiritual wealth of a nation, is not just a tradition or set of values; it also contains scientific ways of thinking, profound wisdom, and a rich knowledge system. It can provide worldview and methodological guidance for technological innovation, a continuous stream of inspiration and creativity, and knowledge and data support. This enhances technology's usability, adaptability, and ease of use, enabling it to better understand human needs and making

technology more intelligent. The ways of thinking embedded in culture, such as systems thinking and critical thinking, are enlightening for technological innovation. Examples include Newton's unification of classical mechanics, Einstein's formulation of the theory of special relativity, and Prigogine's construction of the theory of dissipative structures. Another example is Copernicus's questioning of the geocentric theory and the establishment of the heliocentric theory, which laid the foundation for modern astronomy.

C. Culture Imbues Technology with Beauty

The emergence of concepts such as *Silk Punk* and *Cyber ShanShui* in the Chinese-speaking science fiction community indicates that culture integrates Oriental aesthetics into science fiction and art, illuminating cold, lifeless objects and infusing the technological world with captivating beauty. AI is used to create brushstrokes and moods reminiscent of classical Chinese landscape paintings, reviving the elegance of Chinese aesthetics. As Zong Baihua said, "*All beauty originates from the source of the soul. Without the mapping of the soul, there is no such thing as beauty* [3]." Beauty is a subjective experience of the human soul, and culture brings spirituality and aesthetics to the technological world. From the different categories of beauty itself, "*culture endows technology with beauty*" manifests at three different levels: culture provides technology with aesthetic perception, continuously generates new aesthetic activities, and nurtures beautiful life realms and social fashions in a technology-dominated world.

V. TECHNOLOGY SHAPES, EMPOWERS, AND STRENGTHENS CULTURE

On August 20, 2024, China's AAA single-player game *Black Myth: Wukong* was officially released and quickly sparked widespread discussion. Within three days, the game's sales surpassed 10 million copies. Agencies predict that *Wukong* will ultimately sell 20 million copies, with final sales expected to exceed 6 billion yuan. The reason for *Wukong*'s global popularity lies largely in the support of high technology. Taking just the special effect shot of brush writing in the cutscenes as an example, "*The interaction between the brush and the paper during writing requires extremely high model skeleton binding, coupled with the trajectory following of ink transitioning from dark to light. This is a technology worthy of publishing a paper* [4]." The laws of historical development have shown that every major revolution in technology brings about a fundamental transformation in social production and lifestyle. In the era of digital intelligence, the integration of technology and culture is igniting new sparks of modern civilization.

A. Technology Gives Form to Culture

The core of culture lies in its ideas, spirits, and values, which, though immaterial, are of utmost importance. Through technological means, we can overcome the difficulty of expressing these intangible aspects, making cultural elements visual and sensory, thereby greatly enhancing culture's expressiveness, appeal, and vitality. This, in turn, stimulates and mobilizes the cultural productivity and creativity of the entire society. Historically, cultural progress

has been closely linked to technological development. Papermaking and printing laid the foundation for cultural inheritance and gave rise to the book publishing industry. Electrical technology made it possible to record images and sounds, driving the development of radio, film, and television. In the new round of technological revolution, advanced technologies such as 3D scanning, digital technology, holographic projection, AI, and AR are widely applied, providing new carriers and opportunities for cultural prosperity and development, and inspiring cultural innovation vitality. The in-depth application of digital technology can transform traditional cultural content into digital cultural products. Through virtual reality and augmented reality technologies, people can immersively experience historical scenes, artworks, and cultural heritage, significantly enhancing the interactivity and autonomy of cultural experiences. For example, the Hangzhou Branch of the National Archive of Publications of China uses digital technology to showcase the charm of Chinese culture, bringing cultural relics to life; the Sanxingdui Museum utilizes 3D laser scanning technology to discover the intrinsic connections between artifacts across pits, successfully unearthing and highlighting hidden cultural information. Virtual reality technology enhances cultural expressiveness, big data enables the mapping and visualization of cultural content, and the Internet of Things enhances the perception of cultural scenes. Digital cultural equipment, such as smart terminals, enriches cultural experiences, making them more three-dimensional and direct.

B. Technology Empowers Culture

Technology is the primary productive force, injecting new momentum into the cultural sector, driving industrial transformation, and revitalizing cultural forms and content. Marx astutely pointed out that once papermaking and printing emerged, they quickly became "*means for the revival of science and the most powerful lever for creating the necessary prerequisites for spiritual development* [5]". Today, cutting-edge technologies such as AI and cloud computing have given rise to emerging industries like digital art and online performances, changing the way culture is disseminated. For instance, the *Comprehensive Series of Chinese Paintings Through the Ages* establishes an image resource library, the Forbidden City uses VR technology to display cultural relics, and the *Wuxi Cliff Carvings* utilize digital technology to revive eroded characters. Digital technologies such as big data, AI, and VR break the boundaries of time and space, bringing cultural venues, intangible cultural heritage, and cultural relics to life. Digital museums offer 360-degree panoramic views, allowing people to appreciate culture from the comfort of their homes. CG technology animates Chinese culture, 3D modeling makes historical artifacts popular, and digital twin technology revives historical cultural traditions. Technology also promotes cultural exchange and mutual learning, with digital visual creative works becoming popular worldwide. Digital and intelligent technologies reshape the space for cultural dissemination, unlocking new scenarios of diverse resonance, human-machine interaction, and the integration of virtual reality. Immersive exhibitions and performances are thriving, and AI creation is in its ascendancy. For example,

the Guiyang Long March Digital Art Museum uses holographic and VR technologies to reinterpret the story of the Long March. The Luoyang digital immersive performance *Tracing the Goddess Luo* provides a fully immersive experience. Robots copy the *Wansui Tongtian Tie*, demonstrating the continuation of traditional culture through technological innovation. Technology presents culture in a more vivid and lively manner, deeply resonating with people.

C. Technology Strengthens Culture

Technology drives cultural innovation, fosters new industries, and promotes economic, social, and civilizational development. Technological progress brings about changes in both the cultural supply side and the consumption end, giving rise to a host of new cultural formats, industries, scenarios, and consumption patterns, forming a new type of productive force. This new productive force is driven by the dual wheels of technology and culture. Technology provides new tracks and spaces for the formation of this new cultural productive force, helping culture to stand out. Digital technology has given birth to new cultural formats such as online literature and short videos. The combination of digitalization and creativity promotes the cross-border integration of cultural formats. The integration of culture and technology extends the industrial chain, gathers talent and technology, fosters new growth points, and enhances the quality and efficiency of cultural products and services. Technology enhances the value of the industrial chain of the new cultural productive force. *Cloud exhibitions* and *digital scenic spots* expand the audience and achieve the iterative upgrading of traditional cultural formats. Digital technology enables full digital management of the cultural industry, improving collaboration efficiency and innovation capability. Technologies such as VR, AR, and AI create diverse interactions, satisfying the demand for experiential cultural perception. For example, the *Shougang No.1 Blast Furnace-SoReal Sci-Fi Park* integrates old industrial sites with innovative technology, becoming a popular destination for science education and research. Technology assists in the iteration of production materials and tools for the new cultural productive force. *"Ancient DNA analysis reconstructs the history of human origins and migrations, opening a door to the unknown world. Breakthroughs in deep-sea technology equipment have enabled China's underwater archaeology to explore from waters 50 meters*

deep to 2,000 meters deep [6]." Technology has a profound impact on culture, encompassing not only information and digital technologies but also cultural heritage technology and equipment research and development.

VI. CONCLUSION

The beauty of culture nourishes the soul, while the light of technology illuminates the future. Throughout the long river of human history, every fusion of culture and technology has erupted with astonishing power, akin to the nuclear fusion generated by the combination of deuterium and tritium, driving innovation and reform. Currently, a new round of technological and industrial revolutions is sweeping across the globe. The deep integration of culture and technology characterized by digitization, networking, and intelligence is an irresistible trend, poised to profoundly reshape human society. Culture is the root of national spirit, and technology is the foundation of national strength. Promoting the mutual convergence and integrated development of culture and technology is not only a historical necessity but also a pressing reality, constituting a significant era-defining proposition that we face.

CONFLICT OF INTEREST

The author declares no conflict of interest.

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