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Examining the Past, Present, and Future of Media Evolution from an Evolutionary Perspective: Post-Print

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Abstract

From the fundamental viewpoints and modes of thinking of media evolution theory, this paper elucidates the five elements, seven characteristics, and humanization trend of media evolution; analyzes the transformation of thinking patterns and evolutionary models in the process of media evolution; interprets the concept of the metaverse; and prospects the future development of media.

Full Text

Preamble

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In a previous paper titled "A Review of Media Evolution History" (published in *China Media Technology*, Issue 8, 2019), I proposed the fundamental viewpoints of "media evolution theory": the "gene" of media is replicable information symbols; "variation" of media genes is the source of iterative media evolution; improvement of media gene "replication mechanisms" also drives iterative evolution; "media hybridization," "transgenesis," and "gene editing" are evolutionary patterns leading to morphological diversity; and humans play the role of "natural environment" in the "natural selection" of media [1]. This article applies these basic viewpoints and thinking modes of media evolution theory to examine the history of media evolution, interpret the currently much-discussed concept of the metaverse, and prospect the future development of media.

1. The Five Elements of Media Evolution

1.1 Demand: The Driving Force and Innovation Orientation

All media throughout history have evolved under the pull of information, sensory, and psychological demands. The energy accumulated by this demand-pull gradually forms an impact force, and when this force becomes sufficient to break through the weakest link of old media, a new media form emerges. Demand also evolves with the times and continuously deepens. Moreover, demand serves as the orientation for media innovation. For instance, who determines the development direction and functions of future 6G? Demand does. Thus, we can anticipate that wide-area communication, heaven-earth integration, sensor integration, and new services may become the development directions for future 6G.

1.2 Medium: The Material Foundation

Medium is the carrier of symbols, the wings of media, and the material foundation of information dissemination. Without medium, symbols would be like castles in the air, lacking support; without medium, media would be like birds without wings, unable to fly far; without continuous medium innovation, how could the history of communication remain ever fresh? For example, without uncovering the mysteries of electricity, information dissemination would probably still be constrained by the speed of wheels and horseshoes today.

1.3 Symbols: The Source and Lever

Media iterative evolution is triggered by variation in symbols or improvement of symbol replication mechanisms; media expansion within the same generation also begins with symbol transformation.

1.4 Environment: The Necessary Condition

The ecological environment is the soil where media germinate and grow. Politics, economy, technology, and society are all important factors affecting media evolu-

tion. Without a favorable environment, new media struggle to emerge; without smooth environmental conditions, even if new media break through, they find it difficult to grow. The binary system originated from China' s Bagua, but was not directed toward computing technology—this is clear evidence. Movable type printing was one of China' s four great inventions, yet it ended up in the awkward situation of "blossoming domestically but bearing fruit abroad."

1.5 Talent: The Key to Successful Media Innovation

All those who have made achievements in media evolution history possess two fundamental qualities: First, they have pioneering and innovative ideas combined with scientifically sound methods. A typical representative is Nipkow, who invented the television scanning principle by drilling several small holes along a spiral line on a disc to create a photoelectric mechanical scanning disc. Second, they have the courage to overcome difficulties and the perseverance to remain tenacious. A typical example is Field, who, after 13 years of experiencing four "fruitless returns" and enduring the humiliation of being called a "fraud," remained undaunted and persistent, ultimately succeeding in laying the transatlantic submarine cable.

2. Transformation of Thinking Modes and Evolution Patterns

Thinking mode refers to the specific way the human brain identifies and judges objective things, conducts logical reasoning, and forms meaningful understanding. In different stages of media evolution, the thinking modes dominating media evolution have continuously changed; under different thinking modes, the resulting media evolution patterns also differ.

Primitive Thinking and Instinctive Reaction. To cope with harsh living conditions, ancient humans lived and worked in groups. Information communication and emotional exchange among them were essential for survival. Without tools available, ancient humans unthinkingly and instinctively used their own organs as means of communication, thus human communication entered the stage of body language communication. This "unthinking" thinking can be called "primitive thinking," while "instinctive reaction" is the evolution pattern of body language.

Survival Thinking and Forced Action. In a survival environment where the weak fell prey to the strong, human ancestors (Homo sapiens) faced harsh environments and fierce beasts, constantly pondering how to "stay alive"—this is so-called "survival thinking."Under this survival thinking, Homo sapiens had too much information to exchange, too many emotions to express, and too many matters to discuss in the competition for survival. Borrowing Engels' words, "these emerging humans had reached a point where they had something to say to each other," and were finally forced to create unique human speech. Human communication thus entered the oral communication stage, with "forced action"

as the evolution pattern of speech. With speech, Homo sapiens could shape the fictional "God" and use God' s influence to unite everyone to defeat beasts more powerful than themselves, rising from the animal kingdom to the top of the food chain, then conquering their own kind and dominating the world.

Trial-and-Error Thinking and Trial-and-Error Optimization. Speech could not be transmitted far or preserved, prompting ancestors to explore ways to record speech. Lacking accumulated experience and inherited knowledge, "trial-and-error thinking" became their only intellectual weapon for media innovation. Under the guidance of trial-and-error thinking, ancestors actively participated in continuous trial-and-error optimization, finally creating writing and inventing paper, thus opening the written communication stage. "Trial-and-error optimization" became the evolution pattern of writing. From then on, experience could be taught, knowledge could be disseminated, history could be recorded, and civilization could be inherited.

Mechanical Thinking and Technological Innovation. When Gutenberg reformed and innovated movable type and the printing press, human communication entered the printed text communication stage. This simultaneously stimulated Newton' s "mechanical thinking," which flourished in 18th-century Europe: any problem in the world could be solved through mechanical means. Driven by mechanical thinking, the "technological innovation" pattern of media evolution was formed. Through continuous practical exploration, experience accumulation, and technological innovation, it promoted the widespread application of machinery in the media field—from typewriters to telescopes, from cameras to phonographs, from mechanical arm communication towers to mechanical computers, various mechanical media emerged endlessly.

Coding Thinking and Technological Innovation. When the mysterious veil of electricity was lifted, how to use electricity for remote information transmission was put on the agenda. Morse used three symbols of electric current —on, off, and long-off—to electronically encode English letters and punctuation marks, achieving remote information transmission with a single wire. Human communication thus entered the electronic communication stage, simultaneously opening the precedent of "coding thinking." Guided by coding thinking, technological innovation emerged with telephones, fax machines, radio, television, and a large batch of electronic media. "Technological innovation" became the evolution pattern of electronic media.

Computational Thinking and Digital Presentation. In computer science, the entire digital world can be represented by a collection of "0" s and "1" s. "Coding thinking" was gradually replaced by "computational thinking." Under computational thinking, computing is no longer just about computers—it determines human survival. All information forms including text, images, music, films, and television can be digitally presented and processed in computers based on binary code, thus producing a series of new media prefixed with "digital" : digital telephone, digital fax, digital broadcasting, digital cinema, digital television, etc. Human communication thus entered the digital communication

stage, with "digital presentation" as the evolution pattern of digital media.

Algorithmic Thinking and Algorithms as Media. Algorithms are inseparable from computer science—they are instruction sets that take one or several data inputs and produce corresponding outputs through a series of procedures. So-called "algorithmic thinking" involves classifying and organizing different samples, conducting comparative analysis, summarizing patterns, designing a set of rules or instructions, abstracting complex calculations (or problems) into repeatable patterns or modules, and then having computers solve the problems. Under algorithmic thinking, algorithms have in some sense become a higher-level medium: their logic shifts from "transmission"to "connection,"and their function gradually transforms from information transmission tools to bonds connecting relationships. Human communication thus entered the network communication stage. In the intelligent era where everything is connected and everything is media, algorithms constitute the infrastructure and underlying logic of the intelligent era, and "algorithms as media" has become the evolution pattern of media.

3. Seven Characteristics of Media Evolution

3.1 Continuity

New media gradually evolve from the forms of old media; therefore, almost all media have some connections with each other. As McLuhan said, "the 'content' of any medium is always another medium." Language is the content of writing, writing is the content of printing, and printing is the content of radio and television, and so on.

3.2 Compensability

Throughout media evolution history, all media are compensatory media—that is, new media compensate for the inherent defects or congenital deficiencies of old media functions. Due to the inherent defects or functional insufficiencies of old media, they cannot satisfy people' s growing information, sensory, and psychological needs. Therefore, people are constantly thinking about and exploring how to transform old media and create new media. As Sergei Eisenstein wrote in *Notes of a Film Director*: "Silent films cried out for sound, and sound films cried out for color. This observation can be systematically and universally applied to the study of all media."

3.3 Balance (Homeostasis)

Throughout media evolution history, the reason why communication media have remained prosperous is that communication media gradually move from imbalance (or "bias," including time-space bias, sensory bias, influence bias, etc.) toward balance. Taking sensory bias as an example: communication media have different sensory biases—oral communication is biased toward hearing, writing

toward vision; telegraph toward vision, telephone toward hearing; radio toward hearing, while television achieves a balance between vision and hearing.

3.4 Symbiosis

The relationship between old and new media is not a "zero-sum" game but rather a competitive-cooperative and complementary relationship. The emergence of new communication media does not necessarily mean the death of old media, thus forming a symbiotic structure of both competition and complementarity that constitutes today's vibrant media ecosystem. Only when two media occupy the same "ecological niche" (i.e., the time-space position and role a population occupies in an ecosystem) do they engage in life-and-death competition, leading to the death of old media. For example, pagers and mobile phones occupied the same ecological niche, so mobile phones replaced pagers upon emergence. Morse telegraph found its new ecological niche after the telephone' s advent and remains active in amateur radio circles to this day, despite its small living space.

3.5 Embodiment (Embodiment)

Embodiment refers to the fact that many characteristics of human cognition are shaped by human biological "bodily organization." French philosopher Maurice Merleau-Ponty believed that the body is the medium through which we exist in the world, and having a body means participating in a specific communication environment. However, the degree of bodily participation in communication activities is constantly changing. A history of media development can be seen as a history of technology and body entanglement: from initial "bodily media" (humans transmitting information through body language); thereafter, humans gradually "withdrew," becoming "invisible media" (visual and auditory symbols replacing body language); later becoming "virtual bodily media" (humans existing as nodes in networks); then "quasi-bodily media" (technological devices embedded in human bodies); and finally returning to "bodily media" (the human brain becoming media).

3.6 Samsara (Cyclic Nature)

All things have causes and effects, and everything has cycles, and media evolution is no exception. The return from the "original communication ecology" under primitive scenarios to the "original communication ecology" under new technological scenarios; and from "bodily media" in the body language communication era back to "bodily media" in the mind communication era, both reflect the "cyclic nature" of media evolution. In terms of communication modes, the cycle from face-to-face interpersonal communication in prehistoric society to mass communication via newspapers, radio, and television, to divided-audience communication in the network era, and then to personal communication in the mind communication era, is also a cycle.

3.7 Acceleration

Media evolution shows an accelerating trend. Body language communication took millions of years, oral communication to written communication took tens of thousands of years, written to printed communication took over 3,000 years, printed to electronic communication took over 400 years, electronic to digital communication took over 100 years, digital to network communication took less than 50 years, and the transition from PC Internet to mobile Internet took just 10 short years.

4. Humanization Trends in Media Evolution

The "humanization trend," proposed by American media theorist Paul Levinson, means that "media evolve and develop in the direction of increasing human functions" [2]. Some disagree with his view, arguing that an "evolutionary theory" perspective does not necessarily lead to a "progress" conclusion. However, I believe that since humans (or human society) play the role of "natural environment" and dominate the media evolution process, the direction and path of media evolution naturally must conform to human will, making "humanization" an inevitable trend in media evolution.

The humanization trend in media evolution is mainly manifested in:

4.1 Return to the Original Communication Ecology

The original state of communication—primitive interpersonal exchange—is the most humanized. The communication scene is the real world, communicators face each other genuinely, the communication mode is two-way interactive, with the only flaw being that information cannot travel far or be preserved due to time-space limitations. Humans invented written communication to overcome time-space constraints but lost almost all humanized elements of the original communication ecology. Since then, each evolution of media has gradually recovered some lost elements and will ultimately return to a new "original communication ecology" supported by new technologies and new communication scenarios.

4.2 Computational Communication

The deepest truths of the physical world are revealed by the most profound theoretical physics equations. Online reading, web surfing, Baidu searches, Weibo posts, WeChat group formation, and other network behaviors are recorded in the form of digital traces. Based on big data collection and analysis, algorithms have enabled the emergence of communication hotspot tracking, communication phenomenon analysis, media content recommendation, and media influence assessment. Artificial intelligence news, robot journalism, and computational advertising are emerging endlessly, and intelligence will inevitably become a future development trend for media.

4.3 Semantic Encoding

According to Shannon and Weaver, the humanization trend in media evolution can be described as a movement from encoding minimization and decoding maximization toward encoding maximization and decoding minimization. In other words, receivers do less and less decoding while producers do more and more encoding. Simply put, publishers should put in more effort so that audiences can expend less energy.

4.4 Emotional Media

Among all applied technologies, only media technology must satisfy not only general functional needs but also humans' special emotional needs. One unique human characteristic is the reliance on emotions when forming social bonds and constructing social structures. Emotions are expressed, transmitted, and displayed through specific behaviors and symbols, and thus emotions can be perceived and computed. It can be anticipated that introducing emotional computing into the media field will help audiences better achieve emotional resonance and psychological identification, realizing more effective and warmer communication functions.

4.5 Green Media

Shannon proved that acquiring one bit of information requires at least 0.693KT, or approximately 10^-21 joules of energy [3]. It can be anticipated that in the coming Internet of Things era, the energy consumption required will inevitably increase. Therefore, processing, transmitting, and storing the maximum amount of information with minimum energy consumption becomes an inevitable choice, and green development will become one of the future trends in media development.

Like everything having two sides, the humanization trend in media evolution also has negative biases. The cover of Neil Postman' s "Amusing Ourselves to Death" [4], one of his "critical trilogy," depicts a family of four (parents and two children) sitting on a sofa watching television, with lifelike bodies but no heads, metaphorically suggesting that television has hollowed out people' s brains, turning everyone into fools. It criticizes how people willingly become a species that amuses itself to death. Postman' s warning is worth heeding and contemplating. Today, many teenagers indulge in mobile games, neglecting study and lazy in thinking. Tomorrow, as artificial intelligence involvement deepens, will human brains degenerate? In the process of media evolution, human rationality and control are crucial.

5. Interpreting the Metaverse Concept

The metaverse is the successor to mobile Internet. Internet technology has evolved from Web 1.0 (one-way, read-only, static web pages) to Web 2.0 (two-

way read-write, data aggregation), and is moving toward Web 3.0 (autonomous control, embodied communication). If Web 3.0 is the infrastructure based on blockchain, digital identity, NFT, and AR/VR/MR technologies, then the metaverse is the application scenario and lifestyle of Web 3.0—the two complement each other. In the metaverse, embodied communication will replace symbolic communication, and what users share will no longer be simple text, images, or audio-video information in different forms, but a full-body immersive real experience. Web 3.0 and the metaverse have just emerged and have a long way to go.

The metaverse is a higher stage of virtual space. It is a three-dimensional virtual space that maps and interacts with the real world, created through a "gene editing"evolutionary model based on multiple frontier technologies including 5G, Internet of Things, AR, VR, MR, smart wearable devices, 3D graphics rendering, artificial intelligence, high-performance computing, and cloud computing.

The metaverse is an upgraded version of digital life. It not only creates an immersive multi-dimensional digital environment but also introduces new technological elements such as digital identity, blockchain technology, and non-fungible tokens (NFT), providing effective business and social models as well as ownership protection, thereby making online work, study, and life more present and secure.

6. Future Development Prospects from the Perspective of Media Evolution Theory

The space for human technological development is endless, as is media technology and media evolution. According to media evolution theory, variation in information symbols is the main driving force of media evolution. So how will information symbols vary in the future? Where will next-generation media head?

In fact, digital symbols are not the final information symbols for human communication activities, and digital networks are not the last mile for information transmission. For humans, the real destination is not various sensory organs but the brain and central nervous system. Digital symbols must ultimately be converted into sensory signals, received by human sensory organs, and transformed into neural signals that are transmitted via neural networks to the brain and central nervous system for processing, thereby generating human vision, hearing, smell, taste, and touch.

There is still no consensus on what neural signals actually are. Some scientists believe they are electrical signals, others believe they are mechanical waves, and still others believe they are both mechanical waves and electrical pulses. As for the mechanism by which neural networks transmit neural signals and the mysteries of how the brain and central nervous system process neural signals? People remain completely ignorant.

Historical experience tells us that major advances in future media will inevitably be preceded by major scientific discoveries. Scientists have discovered that between two quanta separated by vast distances (light-years or even farther) with no conventional connection, when one undergoes a state change, the other exhibits an almost simultaneous identical state change. This is not coincidence but a phenomenon that has been theoretically proposed and experimentally verified, called "quantum entanglement." Since this "quantum entanglement" phenomenon exists in the objective world, it must be ubiquitous and likely exists in people' s bodies and brains. The human body and brain might be a system in a complex state of "quantum entanglement." If this speculation proves true, then media genes will likely vary from electronic symbols to quantum symbols, information media will likely evolve from electronic media to quantum media, and information communication will likely evolve from network communication to mind communication, with information and knowledge directly input into the human brain through brain-computer interfaces, greatly enhancing human intellectual development. All this awaits new discoveries in brain science theory and new breakthroughs in integrated technologies such as quantum, gene, and chip technologies.

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Special Feature: Technology Enabling Media to Tell the Beijing Winter Olympics Story

In February 2022, the world' s attention focused on Beijing as the Winter Olympics became a hot topic. How to use the Winter Olympics as an opportunity to shape national image and tell China' s story well is the mission and responsibility of media professionals. This Winter Olympics showcased the

power of Chinese culture and the speed of scientific and technological development.

The opening ceremony displayed Chinese-style romance through technologies such as artificial intelligence, 5G, and AR. In event reporting, an 8K+VR live broadcasting system was independently developed to enhance user experience based on the characteristics of winter sports. In terms of dissemination, the "live broadcast robot" of Media Brain helped editors quickly lock onto shots, rapidly clip highlights, and publish them to major platforms with one click. From the live broadcasts and reports of the opening and closing ceremonies and various competitions, it is evident that technology-enabled media reporting has become more diverse in form, more efficient in news product production, faster in dissemination speed, and stronger in visual experience.

This special issue invites frontline technical personnel and industry experts who participated in Beijing Winter Olympics reporting to decode the technical application solutions from the perspective of technology enabling media reporting, and invites scholars to observe technological applications and media development in major thematic reporting from the perspective of journalism and communication studies, hoping to bring some thoughts and inspiration to readers.

Note: Figure translations are in progress. See original paper for figures.

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