

Cognition and Empowerment: AI Perception and Post-Use Effects among Chinese Urban Residents

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Abstract

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Full Text

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such forces. Public perception and use of AI provide a realistic basis for observing and studying the diffusion of AI technology in China. [Method/Process] This study analyzes the AI awareness and usage patterns among Chinese urban residents based on two waves of survey data from the Chinese Academy of Social Sciences Public Opinion Research Laboratory, conducted in 2019 and 2023. [Result/Conclusion] From 2019 to 2023, the practical application effects of artificial intelligence among the populace have become evident. Younger and more educated groups are more likely to access and use AI products or services, while public attitudes toward AI have become calmer and more objective. People are increasingly concerned about potential negative impacts of AI development, and technological anxiety has become widespread. As AI continues to embed itself in daily life and production, the state must pay attention to how this “public opinion landscape” of AI influences AI development itself.

Keywords: Artificial Intelligence; Innovation Diffusion; Technology Empowerment; Technology Anxiety; New Quality Productive Forces

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1 Background and Significance

The development of AI technology represents a new revolution in productive forces that will reconstruct the entire global political and economic landscape. The core of General Secretary Xi Jinping’s concept of “new quality productive forces” lies in using technological innovation to drive industrial innovation. As a significant disruptive technology, AI’s promotion of social transformation represents an overwhelming trend, with “AI+” serving as an important direction for China’s new quality productive forces. “AI empowerment and enabling AI” constitutes a collaborative evolutionary process involving the state, society, and citizens. China’s national strategic layout for Chinese-style modernization and new quality productive forces requires active response from enterprises in terms of technological application, product innovation, and service creation, while ordinary citizens serve as the end-users who adopt and use these new products. Therefore, the development of new quality productive forces driven by AI inevitably involves a 联动 (linkage) and interaction among “state—society—individual” under universal participation.

Politics, capital, and public opinion all play important roles in AI’s development, with the public largely being passive recipients and bearers of “AI+.” However, from a “people-centered” perspective, the subjects of innovation diffusion, technology empowerment, and technological anxiety are individual citizens, and the collective force composed of these individuals forms what can be called AI’s “public opinion landscape,” which in turn influences the diffusion and application of AI technology itself.

Monitoring and tracking Chinese citizens’ AI cognition and usage status through

first-hand survey data represents a depiction of China’s AI “public opinion landscape” based on Chinese practice, much like the China Internet Development Statistics Survey that began in 1997. The Chinese Academy of Social Sciences Public Opinion Research Laboratory first conducted a survey on Chinese netizens’ AI cognition and usage in 2019, and repeated it in 2023 to track technological diffusion after five years. This paper compares the first-hand survey data from 2019 and 2023 to gain insights into the actual connections between technology and people, and to explore how national strategies are perceived and implemented at the popular level.

While we cannot predict the outcomes of technological transformation with high precision, “Paul Saffo’s 30-Year Rule” is often referenced as a framework for new technology development. According to this rule, “whenever a new technology moves from the laboratory to the market, a relatively stable pattern of accelerated development takes effect” [1]. The diffusion of AI in China can be viewed as a study of “human experience” in “AI + society.” For AI technology that has just begun to land at the mass level, this “shallow description” based on Chinese practice not only carries the significance of “deep description” for AI historiography but also offers a multi-dimensional integrative perspective—one that recognizes “social, political, and economic forces playing powerful roles in the development of new technologies” [2].

2 Literature Review

Technology has always been intimately connected with politics. The political nature of technology—its characteristics and role in social, economic, and political life—has long been widely discussed in social sciences. Since the 19th century, debates between technological determinism and social determinism have frequently erupted [3]. While these approaches dispute the magnitude of technology’s impact on politics, both attempt to understand the relationship between technology and politics. Contemporary scholars increasingly combine these two paths as a more fruitful and illuminating explanatory model, recognizing that “technology has political attributes while functioning within political contexts” [3].

“Technological nationalism” serves as an important concept for constructing the “technology—state—society—citizen” framework. It means that “technology is fundamental to national security and economic prosperity, a country’s development policy must have clear strategic support, technology must be localized at all costs, and diffused throughout the entire system” [4]. Technological nationalism is considered an important driving force for China’s development, with consistent cognitive 传承 (inheritance) at the national level regarding science and technology’s role in promoting national development and prosperity. Developing science and technology holds “key” and “overwhelming” strategic significance in China. This top-down effective promotion of science and technology has be-

come an important driving force for China's transformation and rapid economic growth since reform and opening up. Today, AI as a national strategy for new quality productive forces represents a vivid continuation of this technological nationalism.

Based on the reality of China's internet diffusion, Zheng Yongnian conducted in-depth research on how the internet transformed Chinese society, "constructing a political analysis" with "technology empowerment" as the main thread to interpret the mutual construction among "state—society—citizen" [5]. This "political analysis" provides a more macro perspective to observe how the internet transforms society, considering the reality of technology empowerment alongside internet diffusion among state, society, and individuals. British scholar Chadwick constructed an analytical framework of "state and new communication technology" and "citizen and new communication technology" with the internet as a technological intermediary, based on the "political nature of technology" [3]. These political frameworks share the same logic as American scholar Castells: the internet, as a new productive force (equivalent to the steam engine's significance for the industrial revolution), will inevitably transform and reconstruct production relations, while this process from productive force transformation to production relation reconstruction is based on specific social systems, cultures, and local practical applications of the internet [6].

In reflections on China internet research, many scholars have emphasized the importance of reality-based development and user perspectives. In 2016, Italian scholar Balbi and Chinese scholars Chen Changfeng and Wu Jing jointly proposed "calling for a (new) Chinese media history," where the "new" part includes research on the history of computers, the internet, and mobile phones [7]. Italian scholar Bahroun [8] argues that existing histories of China's internet have mostly focused on technology and its social impacts, with insufficient attention to users, who should be emphasized as the core of internet information exchange and communication.

As a new technology with equivalent significance to the internet as a new quality productive force, AI has just begun to drive social transformation in China. Drawing on lessons from internet research, the Chinese Academy of Social Sciences Public Opinion Research Laboratory added "public AI cognition and usage" to its ongoing "China Public Opinion Index Survey," successfully completing surveys in both 2019 and 2023. The 2019 survey can be regarded as the starting point survey for the "AI inaugural year" (2019 is considered the beginning of AI's commercial and social application in China), while the 2023 survey represents a re-monitoring after five years of AI diffusion. The questionnaire design primarily builds on the above research experience, following the "technology—state—society—individual (public)" framework and focusing on Chinese users' AI practices and usage.

Current research on AI's impact on Chinese society mostly consists of speculative, theoretical, and predictive analyses forecasting various impacts of AI development. Studies based on AI's actual application in China are mostly

commercial and technical reports, such as the “China AI Large-Scale Industry Development Report.” The surveys by the Chinese Academy of Social Sciences Public Opinion Research Laboratory examine the actual situation of AI technology diffusion in China from the perspective of Chinese citizens’ AI usage and cognition development, with these survey data providing authentic records of China’s AI diffusion practices.

3 Analytical Framework and Data Description

3.1 Framework Construction: “Technology—State—Society—Individual (Public)”

Based on previous research experiences including “political analysis of internet development,” “network sociology,” and “user-level history,” this paper extends the internet research path of “state—society—individual (public)” to a “technology—state—society—individual (public)” framework. Viewing AI as a new technology and new quality productive force, and combining perspectives from political science, sociology, and communication studies, this study provides an empirical “shallow description” of AI cognition and usage among Chinese citizens based on questionnaire surveys.

The questionnaire indicators were designed around major issues and focal points in internet research, primarily including: (1) technology diffusion status and characteristics of early adopters; (2) technology empowerment of ordinary citizens; and (3) public basic cognition of AI, technology anxiety, and perceptions of China-US AI development. These constitute the descriptive outline for the main findings presented in this paper.

3.2 Data Sources and Sample Descriptive Analysis

This study utilizes data from the “AI Cognition and Usage” special section of the Chinese Academy of Social Sciences Public Opinion Research Laboratory’s surveys conducted in July 2019 and July 2023. The “China Public Opinion Index Survey” is a brand survey project of the laboratory that has been conducted continuously since March 2013. The special survey on Chinese citizens’ “AI Cognition and Usage” was implemented as quarterly surveys for four periods each year in 2019 and 2023.

Target Population: Chinese netizens aged 18 and above in prefecture-level and above cities, covering 287 cities with a population of 560 million. **Survey Content:** Public understanding and cognition of artificial intelligence, contact with AI applications and services, usage of AI products, etc. **Sampling Design Principles and Approach:** All prefecture-level and above cities were stratified into large, medium, and small categories based on population size, with 20 survey cities determined and sample city numbers allocated according

to each stratum's population proportion for stratified sampling. During implementation, quota sampling based on each city's statistical agency population data ensured sample demographic characteristics matched the target population. Because sampling was conducted only at the city level, this paper uses "urban residents" in its title.

This study analyzes Chinese citizens' basic AI cognition and usage based on the July 2019 and July 2023 survey data, while longitudinally comparing changes in AI cognition and usage, recognition of relevant viewpoints, and usage levels between the two surveys, with analysis conducted after 对照量表计算 (calculating based on 对照量表). Based on research experience, two most distinctive demographic groups were selected for comparison: (1) age comparison groups: 18-35 years old and over 35; (2) education comparison groups: bachelor's degree and above, and below bachelor's degree. The July 2019 survey had 4,000 valid samples, while the July 2023 survey had 5,000 valid samples. The demographic characteristics and group distributions of the valid samples from both surveys are shown in Table 1 .

4 Main Findings

American scholar Rogers' "Innovation Diffusion Theory" is considered the primary model for technology diffusion, positing that the cumulative number or proportion of innovation adopters follows a relatively regular S-shaped curve over time—slow initial growth, rapid increase, and final slowdown (as shown in Figure 1 [Figure 1: see original paper]). The theory categorizes adopters at different time nodes into: A (Innovators, 0.2%-2.8%), B (Early Adopters, 9.5%-20%), C (Early Majority, 29.1%-32.1%), D (Late Majority, 29.1%-32.1%), and E (Laggards, 21.4%-23.5%) [9]. Adopters generally undergo five main stages when accepting a new technology: knowledge, persuasion, decision, implementation, and confirmation, with interpersonal communication from surrounding people influencing adopters' attitudes and thus their adoption process.

4.1 Varying Diffusion Patterns Across Different AI Products and Technologies

The surveys reveal that AI-related technologies and products have extensive public contact and usage, but diffusion varies across different products and services. Common AI products or services that citizens have encountered are shown in Figure 2 [Figure 2: see original paper]. Currently, "facial recognition" and "smart home" are the most widely contacted and used by the public. Overall, from 2019 to 2023, each product or service saw a certain increase in contact rates, with "smart home" and "facial recognition" showing the largest increases. By July 2023, public contact rates exceeded 80% for "facial recognition," reached 65% for "smart home," and stood at 46% for "smart wearable devices."

According to the innovation diffusion curve (Figure 1), “late majority” adopters have already accepted “facial recognition” and “smart home,” with diffusion roughly corresponding to the D section of the curve (since the adoption number m for different technologies is a variable constant). Based on survey data, other AI services or products remain in early diffusion stages with relatively low contact rates, though diffusion speeds differ. For instance, only 12.5% of people have encountered “robot writing,” but its contact rate increased significantly compared to 2019, indicating relatively fast diffusion. “Smart translator” has been contacted by 28% of people, but its diffusion speed is slower. Whether these products will achieve diffusion scope or speed comparable to “facial recognition” or “smart home” remains to be observed.

4.2 Young, Highly Educated Groups as “Early Adopters” of AI Products and Services

Comparative analysis by group reveals that younger and more educated groups contact AI products and services earlier and more frequently (as shown in Table 2). Across the six common AI applications listed, contact rates among the 18-35 age group and bachelor’s degree and above group far exceed those of their comparison groups. These characteristics of youth and high education also confirm Rogers’ summary of “early adopter” traits [10]. Taking “robot writing” as an example, in 2019 there were no obvious education or age differences among contact groups, but by 2023, contact rates among the 18-35 age group and bachelor’s degree and above group were significantly higher than their counterparts. Both “early adopters” and “early majority” exhibit classic innovation diffusion characteristics, with young and highly educated groups exerting positive influence on AI product diffusion.

Notably, the typical demographic characteristics of the “early majority” may disappear after technological innovation diffuses to a larger scope and speed slows. “Facial recognition” demonstrates this pattern: in 2019, the 18-35 age group had significantly more contact with facial recognition than the over-35 group, and the bachelor’s degree and above group also had slightly higher contact rates than the below-bachelor’s group. However, 2023 data show no obvious comparison group differences, with approximately 80% of people overall having encountered facial recognition—covering essentially all groups except “laggards” according to the innovation diffusion curve. Five years later, “smart home” contact rates also increased substantially, with comparison group characteristic differences becoming insignificant and overall contact rates exceeding 60%. Of course, this popularization and rapid development are also closely related to product abundance and decreasing consumer prices.

4.3 Declining Attention, More Rational Attitudes

Comparative data reveal that while public contact with AI has increased, attention to AI topics has declined, and public cognition of AI has become more rational. Calculating public attention to “artificial intelligence” topics on a

5-point scale converted to a 100-point system yields the comparison shown in Figure 3 [Figure 3: see original paper]. In 2019, public attention to AI topics scored 67.5 points, dropping to 59.8 points by 2023, indicating that initial AI enthusiasm has faded and attitudes are becoming more rational.

Public perception of new technology's practical effects primarily comes from personal life scenarios and usage experiences, with real-world cases directly influencing public cognition. For example, in the 2023 survey, 49.4% of respondents paid attention to news about “fraudsters using AI to commit telecom fraud,” the highest attention rate among recent AI hotspot events (as shown in Figure 4 [Figure 4: see original paper]). In May 2023, police released a typical case of AI-enabled telecom fraud where a tech company legal person in Fuzhou was defrauded of 4.3 million yuan in 10 minutes, attracting widespread public attention [11]. Public attention to AI hotspot events follows the principle of personal relevance.

Comparisons of “attention to AI-related topics in the past six months” by age and education groups (as shown in Figure 5 [Figure 5: see original paper]) indicate that both the 18-35 age group and bachelor's degree and above group pay more attention overall.

Survey results also show declining recognition of the statement “I pay close attention to AI development” (as shown in Table 3). Compared with 2019, the attention score dropped by about 10 points in 2023, with consistent declines across both age and education comparison groups. This demonstrates that the public no longer worships AI as they did when applications first emerged in 2019. As technology diffuses, the first stage of Paul Saffo's 30-Year Rule—“tremendous excitement, tremendous confusion”—has passed for these common AI applications.

4.4 Declining Blind Optimism, Growing Concern About AI Harms

The public is no longer blindly enthusiastic about AI as they were in 2019. While optimism has declined, concern about potential AI harms has emerged. Recognition scores for the statement “I am optimistic about AI” are shown in Table 4 , revealing declining blind optimism with consistent trends across age and education comparison groups. This precisely marks a new stage in AI diffusion—after excitement and confusion fade, increased application and experience lead to a sense of “oh, what's the big deal, it's just standard technology.” Meanwhile, increased media coverage and discussion of AI fraud, privacy violations, unemployment, and AI ethics have also popularized more knowledge and concepts.

Concurrently, recognition of “I worry about AI harms” increased by nearly 10 points (as shown in Table 5), with consistent trends across comparison groups. This attitude shift aligns with the “technology panic curve” proposed by Atkinson, president of the US Information Technology and Innovation Foundation (as shown in Figure 6 [Figure 6: see original paper]). This curve describes how pub-

lic panic about a technology changes during its application process. When a new technology first emerges, the public knows little about its negative impacts and generally holds positive attitudes with high trust. As understanding deepens, the public swings between trust and panic, easily influenced by false statements [12]. After five years of diffusion and communication, people's understanding of AI has gradually deepened, and they have begun to recognize AI from broader and deeper perspectives.

4.5 Growing Technology Anxiety and Unemployment Fears

As AI technology develops, public technology anxiety has become increasingly apparent. Recognition scores for “I am anxious about not keeping up with technological development” have risen significantly overall, showing more pronounced age and education group differences, with the over-35 group and below-bachelor's group experiencing more pressure and greater concern about falling behind (as shown in Table 6).

The most direct manifestation of technology anxiety is concern about AI-driven unemployment. In the AI era, workers' specific labor content becomes simplified, requiring only decision-making, responsibility, and innovation. Everyone can contribute means of production, producer status tends toward equality, and wealth distribution faces adjustment, creating more opportunities for all [13]. Meanwhile, as AI technology penetrates all industries, AI replacing human labor is inevitable. Some scholars argue that AI's development trend in production processes is to completely exclude living labor, meaning that under technologically permissible conditions, the organic composition of capital will develop toward its maximum limit, reducing workers' reemployment possibilities and making unemployment absolute and long-term [14]. The “unemployment crisis” brought by AI has attracted global attention, and “unemployment fear” caused by AI is genuinely spreading among the public.

Survey results show that public recognition of “I worry AI may replace my job” averages about 45 points, with slight differences between age and education comparison groups (as shown in Figure 7 [Figure 7: see original paper]). Relatively speaking, younger groups and less-educated groups show greater anxiety. Various articles and predictions about AI replacing human jobs circulate online, inevitably influencing the public. AI's future employment trends will have greater impact on young people, who naturally worry more. Less-educated groups face higher possibilities of job replacement by AI, potentially at faster speeds, thus experiencing greater anxiety.

The best solution to technology anxiety is learning new technologies. The July 2023 survey shows that over 60% of citizens “actively learn AI-related knowledge.” The 18-35 age group and bachelor's degree and above group are more proactive in learning AI knowledge (as shown in Figure 8 [Figure 8: see original paper]), providing a strong mass foundation and important human resource guarantee for China's development of new quality productive forces.

4.6 Objective and Rational Understanding of China-US AI Technology Development

AI has become one of the main arenas for great power competition and future technological races. Surveying Chinese citizens' cognition and expectations of AI development in both countries reveals relatively objective and rational views. In the 2023 survey, recognition scores for “China’s AI development ranks among the world’s top tier” averaged about 60 points, 10 points lower than the 2019 average of 70 points (as shown in Table 7). Recognition of “Current Chinese AI development cannot match the US” in 2023 was higher than in 2019. The release of breakthrough AI application tools like ChatGPT and Sora in the US sparked strong reactions in China, prompting ordinary citizens to reconsider China-US AI development with more rational and objective attitudes—another manifestation of more mature and rational public cognition of AI.

5 Reflection and Discussion

General Secretary Xi Jinping’s discourse on “new quality productive forces” represents an important judgment on the current era’s characteristics where technology serves as the core force of social transformation, with artificial intelligence being a crucial foundation for China’s development of new quality productive forces. Monitoring and recording Chinese citizens’ AI cognition and usage status through first-hand survey data holds not only significant importance for technology development history but also provides alternative insights for national AI strategy. AI innovation diffusion is a process of universal participation. In China, “AI empowerment” represents the state-level active macro-layout, “enabling AI” involves innovation and pursuit by enterprises and capital at the societal level, while ordinary citizens mostly select and adapt among existing AI products and services. Chinese leaders have always emphasized people’s sense of gain, happiness, and security; therefore, ordinary citizens’ AI cognition and usage should be regarded as a structurally fundamental part of AI’s social transformation in China—seen, recorded, and valued.

The AI innovation diffusion process is one of empowerment, entrustment, and meaning-making. AI is not merely technology but also culture, institutions, and social relations. For ordinary citizens, their cognition, acceptance, and usage of AI are largely influenced by the social public opinion environment. From this perspective, social public opinion, culture, and institutions serve as important influencing factors that cannot be ignored in the “technology-to-ordinary people” link.

Technology anxiety represents another side of the technology-people link, primarily including occupational replacement, privacy protection, ethics, digital divide, and human-machine relations, with unemployment being the core of ordinary citizens’ anxiety. A report by the McKinsey Global Institute predicts that “by 2030, one billion jobs will be replaced by robots” [15], attracting widespread

global attention. The report also notes that “under a rapid automation scenario, about 100 million people in China will face occupational transition by 2030” [15]. As seen in the survey results, these concerns have already reached ordinary citizens.

“Technology empowerment” is a broad, inclusive phenomenon of high probability. However, AI empowerment is not comprehensive or evenly distributed—this is the classic debate between “empowerment” and “divide.” The differential characteristics of AI empowerment targets determine the uncertainty of empowerment outcomes, namely their uneven and non-egalitarian nature. This may be the basic pattern of AI empowerment, which will persist for a long time. Some scholars attribute the logic of AI’s uneven empowerment to the combined effects of social division of labor and technology diffusion [16], with concerns that AI may reinforce population differentiation being raised again in academic discussions.

New technology diffusion can be viewed as a new productive forces revolution that will readjust the entire world political and economic landscape. Yet for people in different countries and societies, the processes and paths of becoming stronger through technology differ enormously. In this process, “artificial intelligence is becoming a privilege, an extremely exclusive one” [17]. AI expert Fei-Fei Li worries that the high costs of training AI will lead to academia’s dependence on tech companies, stating that “this unbalanced power dynamic is shaping the field in subtle ways, causing AI scholars to adjust their research for commercial purposes” [17].

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