

Research on Ergonomic Factors in Television Development

Jingyi Li, Guofa Zhao and Chuhan Wang*

Southwest Petroleum University, School of Economics and Management, Chengdu 61000, China

Email: 1017579265@qq.com

How to cite this paper: Li, J. Y., Zhao, G. F., & Wang, C. H. (2025). Research on ergonomic factors in television development. *Economics & Business Management*, 2(2), 11-21. ISSN Print: 3079-5214; ISSN Online: 3079-5222.

<https://doi.org/10.63313/EBM.9073>

Published: 2025-07-07

Copyright © 2025 by author(s) and

Erytis Publishing Limited.

This work is licensed under the Creative

Commons Attribution International

License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Abstract

This paper explores the application of ergonomic factors in television design in depth, aiming to provide theoretical support and practical guidance for the further development of television technology. Based on the analysis of influencing factors, this paper proposes optimization suggestions such as visual interface design, voice recognition technology, and intelligent recommendation systems to improve the operational experience and technical performance of televisions. The study finds that innovations in visual interface design, diverse interaction methods, the introduction of intelligent recommendation systems, and upgrades in audio and display technologies collectively enhance the competitiveness of television products, providing important theoretical support and practical guidance for the design and market strategies of future television products.

Keywords

Television; Human-computer interaction; User experience; Intelligent services

1. Introduction

1.1. Research Background and Significance

1.1.1. Television as an Important Role in Family Entertainment and Information Dissemination

The television plays an indispensable role in family entertainment and information dissemination, not only promoting interaction among family members but also providing important educational resources for the growth of children and adolescents. Television plays a significant role in family interaction. According to a 1983 study, television is not only a medium for communication among family members but also an important manifestation of social functions, and through the application of the family system model, the role of television in the family can be better understood[1]. Despite the advent of the internet era posing challenges to traditional television media, television still maintains its core position in family life, becoming the spatial focal point, entertainment center, and emotional core of the home[2]. Television also has a significant impact on the growth and development of children and

adolescents. Television media is regarded as a close companion for young children, children, and adolescents, playing a decisive role in family education and consumption[3], and the popularity of television has also had a considerable impact on individuals and families, becoming an important channel for understanding external information. Additionally, television culture, as a consumer culture, participates in the construction of social material and spiritual culture. Television entertainment programs are not only a cultural form but also bear the responsibility and obligation of cultural inheritance[4].

1.1.2. The Importance of Ergonomic Factors in Television Development

Ergonomic factors play a crucial role in the development of television, and their importance is reflected in multiple aspects. They are not only related to the advancement and innovation of television technology but also directly affect user experience and satisfaction. With technological progress and changes in consumer demands, the human-computer interaction technology of smart TVs continues to evolve to provide a more convenient and comfortable user experience. For example, smart TVs achieve a shift from traditional viewing modes to participatory, intelligent modes through technologies such as new remotes, motion sensing, voice recognition, and multi-screen interaction[5]. The design of human-computer interaction is not only aimed at improving operational convenience but also at meeting users' psychological and emotional needs during use. The development of modern television emphasizes a "human-centered" design philosophy, which means that the design and functional settings of television need to revolve around the actual needs and usage habits of users[6]. This human-centered design philosophy helps television better integrate into family life, becoming an important tool for communication and entertainment among family members. With the rise of social media, the functions of television are also evolving in a social direction. In the future, television will not only be a receiver of information but also a social platform capable of enabling multi-directional interaction between people and machines.

1.2. Research Objectives

(1) Understanding the Impact of Human-Computer Interaction on TV User Experience: Analyze the role and influence of different human-computer interaction designs in the TV user experience, explore how to enhance users' comfort and efficiency when using TVs by optimizing interface design, interaction methods, and user experience design.

(2) Exploring the Application of Artificial Intelligence Technology on Televisions: Research the latest advancements of artificial intelligence technology in the TV field, such as voice recognition and intelligent recommendation systems, evaluate the impact of these technologies on user interaction, content recommendations, and personalized experiences, and explore their potential and application directions in future TV development.

(3) Analyzing the Integration of TV Design and Ergonomics: Analyze the degree of integration between TV hardware design and ergonomic principles, discuss how to improve the comfort and health of TV viewing by designing interfaces that better align with human auditory and visual habits and physiological characteristics, and reduce visual fatigue and physical discomfort during use.

(4) Evaluating the Impact of Ergonomic Factors on Market Competitiveness: Evaluate the competitive advantages of different ergonomic factors in the TV product market, explore which factors significantly influence consumer purchasing decisions and brand loyalty, and help formulate market strategies and product optimization directions for future TV products.

(5) Propose suggestions and prospects for the future development of television: Based on research results, propose the ergonomic factors that should be emphasized in the future development of television, how to innovate in design, technology integration, and user experience optimization to meet the ever-changing consumer needs and technological trends.

2. Literature Review

2.1. Evolution of Television Technology

In the early 20th century, television technology mainly existed in a mechanical form, and then evolved into electronic television. During this period, television primarily used black and white displays until the advent of color television, when the quality of the television screen was significantly improved[7]. With the advancement of technology, television transitioned from analog to digital signals, which not only improved image quality but also enabled television to provide more functions and services[8].

After entering the 21st century, liquid crystal display technology (LCD) became mainstream, quickly replacing traditional cathode ray tube (CRT) televisions with its thin, lightweight, and energy-saving features[9]. The emergence of LCD TVs significantly improved the viewing experience, particularly in terms of viewing angle, response time, brightness, and contrast[10].

Subsequently, the advent of smart TVs marked a new phase in television technology. Smart TVs are not just devices for watching traditional television programs; they also integrate internet functions, allowing users to access online content such as videos and games through their smart TVs[11]. Additionally, smart TVs support the installation and updating of applications, making their functionality richer and more diverse[12].

In recent years, OLED TVs have begun to attract market attention. Compared to LCD TVs, OLED TVs offer better black performance and higher contrast, making the images appear more vivid and realistic. At the same time, the self-emissive nature of OLED TVs means they can be made thinner, opening up more possibilities for future television design[13].

The development of television technology is a process of continuous progress and innovation, from the earliest mechanical TVs to modern smart TVs and OLED TVs, each step reflects technological advancements and changes in consumer demands.

2.2. Application of Ergonomic Factors in Television Development

When discussing how ergonomic factors such as user interface design, interaction methods, and smart features influence the design and user experience of televisions, we can analyze it from multiple dimensions.

First, user interface design is one of the key factors affecting user experience. The human-computer interaction interface design of flat-screen televisions directly impacts the user experience and design quality[14]. With technological advancements, the interaction design of smart TVs is continuously improving. The application of new technologies such as innovative remotes, motion-sensing technology, voice recognition, and multi-screen interaction provides users with richer and more convenient interaction methods[15]. Additionally, the emotional design of smart TV system interfaces can meet users' emotional needs and enhance the user experience[16].

Innovations in interaction methods are also an important way to enhance user experience. For example, research on natural interaction design shows that natural interaction has become a significant way of human-computer interaction in smart products, bringing users a completely new experience[17]. Meanwhile, studies on smart TV interaction design oriented toward user behavior indicate that by deeply researching user behavior, interaction design models oriented toward user behavior can be constructed, thereby improving the user experience[18].

The addition of smart features is also an important aspect of improving TV design and user experience. Smart TVs implement interactive application functions based on the internet, such as live TV channels, catch-up, on-demand, and lifestyle services, greatly enriching the user experience. Additionally, there is research on the smart TV interface interaction design for specific user groups (such as the elderly), which enhances the elderly's experience with smart TVs through age-friendly design strategies[19].

However, despite continuous advancements in human-computer interaction technology and smart features of smart TVs, there are still some issues and challenges. For example, the development of smart TVs is still in the preliminary stage of hardware expansion, with problems such as the simple stacking of functions, complex software interfaces, and outdated interaction methods leading to poor user experience, the elderly face difficulties with focus manipulation and video searching when using smart TVs, requiring further optimization of interface design and interaction methods. Ergonomic factors such as user interface design, interaction methods, and smart features significantly impact TV design and user experience, by continuously optimizing these factors, user experience can be enhanced, meeting the needs of different user groups. Future research should continue to explore how technological

innovation and design optimization can address existing issues and further improve the human-computer interaction quality and user experience of smart TVs.

3. Analysis of the Influencing Factors of Ergonomic Factors in TV Development and Optimization Suggestions

3.1. The Impact of Human-Computer Interaction on TV User Experience

3.1.1. Visual Interface Design

Visual interface design is the first impression and primary window through which users interact with the TV. A clear and intuitive interface design can help users quickly find the content they need, enhancing the user experience. Good visual design can also reduce confusion and errors in operation, improving the intuitiveness and predictability of interactions. Optimization suggestions include: making the interface simple and clear; avoiding excessive complexity, maintaining clear information hierarchy and tidy layout; providing personalized setting options for users, allowing them to adjust the interface layout and color schemes to meet the preferences and needs of different users; unifying icon and button styles, maintaining consistency in interface elements to reduce users' cognitive load and learning costs.

3.1.2. Interaction Methods

Different interaction methods affect how users interact with the TV and their experience. For example, voice control, gesture recognition, remote control design, etc., all directly impact the user's operational experience and efficiency when using the TV. Optimization suggestions include: providing support for multiple interaction methods, such as voice, gestures, and remote controls, so users can choose the most convenient way based on specific situations and preferences; combining artificial intelligence and machine learning technologies to enable the TV to better understand and respond to user commands and intentions, improving the fluency and naturalness of interactions; providing clear feedback and animation effects to help users confirm whether their actions are correctly understood and executed, enhancing user confidence and satisfaction.

3.1.3. User Experience Design

User experience design is the core of the entire product design process, comprehensively considering user needs, emotional experiences, and operational processes, thereby influencing users' feelings and attitudes during use. Optimization suggestions include: Conduct in-depth user research and testing to understand user behavior patterns, preferences, and pain points, allowing for targeted design optimization; Continuously collect user feedback and respond and adjust the design promptly to ensure the product remains aligned with user expectations and needs through continuous optimization; Consider users' emotional needs by designing contexts, sounds, colors, and other elements to create a pleasant and comfortable user experience.

3.1.4. Comprehensive Optimization Strategy

Comprehensive consideration of these factors enables the implementation of a full optimization strategy, significantly enhancing the overall quality of the TV user experience and user satisfaction. Cross-functional design teams, including interface designers, interaction designers, user researchers, and engineers, can be employed to collectively optimize all aspects of the product; Additionally, incorporating user participation in the design process, such as user experience testing and prototype testing, ensures that design solutions align with actual usage needs. In technological innovation aspects, Combining the latest technological advancements, such as augmented reality, virtual reality, and artificial intelligence, allows for the continuous exploration and experimentation of new human-computer interaction models and experience design methods.

Through the above analysis and optimization suggestions, it can effectively improve the comfort and efficiency of TV users during the usage process, thereby enhancing the product's market competitiveness and user loyalty.

3.2. Application of Artificial Intelligence Technology on Television

The application of artificial intelligence technology in the field of television is developing rapidly, mainly focusing on speech recognition, intelligent recommendation systems, and personalized experiences. These technologies are profoundly changing the way users interact with and experience television.

3.2.1. Speech Recognition Technology

Speech recognition technology allows users to control TV operations through voice commands, such as switching channels, adjusting volume, searching for content, etc., greatly enhancing the convenience and naturalness of operation. This technology is particularly beneficial for users who are unfamiliar with or unable to use remotes, such as the elderly or individuals with physical disabilities. Recommendations for optimization include: Integrating other smart devices; Integrating voice control with other smart home devices, allowing users to control the entire home environment through the TV, such as adjusting lights, smart appliances, etc. to meet more of the user's needs.

3.2.2. Smart recommendation system

Smart recommendation systems utilize machine learning algorithms to analyze users' viewing history, preferences, and behavior patterns, recommending personalized content to enhance the user's viewing experience and satisfaction. This technology can help users discover new content, reduce search time, and increase the appeal and relevance of the content. Recommendations for optimization include: Multi-dimensional recommendations; Combining speech recognition technology to gather more user preference data, further improving the accuracy and personalization of recommendations; Real-time recommendations; Adjusting recom-

mended content dynamically based on the user's current status and context, such as adjusting recommendations based on time, weather, user emotions, and other factors.

3.2.3. Personalized experience

Artificial intelligence technology enables TVs to better adapt to and respond to users' personalized needs and habits, thereby providing a more user-expectant experience. Personalized experiences are not limited to content recommendations but also include customized aspects such as interface layout and operation methods. Optimization suggestions include: Integrating environmental perception technologies, such as cameras or sensors, to automatically adjust the TV's display effects, volume, etc., to suit the user's current environment and situation; Continuously learning and analyzing user behavior data to constantly optimize the personalized experience, enhancing user satisfaction and loyalty.

3.3. TV Design and Human Factors Integration

The degree of integration between TV hardware design and human factors principles is crucial for enhancing the comfort and health of TV viewing.

3.3.1. Screen and Display Technology

Due to visual habits and physiological characteristics, the human visual system has specific physiological limitations in perceiving and processing light. Parameters such as the brightness, contrast, and color saturation of TV screens should be considered for eye comfort. Excessive brightness or contrast can lead to eye fatigue and discomfort, especially during prolonged viewing. Optimization suggestions include: the application of eye-protection technologies, some advanced TVs have already started adopting eye-protection technologies, such as low blue light mode and eye-protection mode, these technologies can reduce blue light emission or adjust screen color temperature to minimize eye strain and reduce visual fatigue; adopting high resolution and high refresh rates can enhance image clarity and smoothness, but it is also necessary to consider the human eye's perception of resolution and refresh rates to avoid the negative impact of excessive technical specifications on the viewing experience.

3.3.2. Sound System

A good sound system design not only includes the clarity and depth of sound quality but also considers the surround sound experience and environmental adaptability. Optimization suggestions include: adopting intelligent volume adjustment features, which can adjust the volume based on ambient noise to ensure that the audience can clearly hear the sound without needing to adjust the volume control.

3.3.3. Design of Ergonomics and Spatial Arrangement

Optimization suggestions include: designing reasonable screen sizes and viewing

distances; According to the physiological characteristics and visual habits of the human eye, the size of the TV screen should be adapted to the viewing distance to avoid the burden on the eyes caused by excessively large or small screens; Adjust field of view angle and viewing posture; The installation position of the TV and the field of view angle of the screen should take into account the viewing posture and body posture of different audiences to ensure comfort and physical health during viewing.

In summary, by deeply understanding the principles of ergonomics and combining them with advanced TV hardware design, the comfort and health of TV viewing can be effectively improved, reducing the potential visual fatigue and physical discomfort issues that may arise during use. In the future, with technological advancements and changes in user needs, TV hardware design will place greater emphasis on human physiological characteristics and audio-visual habits to provide a better viewing experience.

3.4. The impact of ergonomics on market competitiveness

In the TV product market, ergonomic factors can significantly impact competitive advantages, the following will analyze in detail several factors that have a greater impact and provide market strategies and optimization directions.

3.4.1. User Interface and Operational Experience

A simple and intuitive operation interface can reduce user learning costs and operational difficulty, enhancing ease of use. Supporting multiple interaction methods such as voice control and gesture recognition, it can meet the personalized needs of different users. Market strategies and optimization directions include: optimizing the product, continuously refining the interface design, adding intelligent recognition and personalized recommendation features to improve user experience and satisfaction; increasing market promotion, emphasizing user-friendly operation experience and diverse control methods as competitive advantages in market promotion.

3.4.2. Image and Audio Quality Adjustment

Adjusting image brightness, contrast, and color saturation, as well as audio volume, equalization, and surround effects, is crucial for the audio-visual experience of users watching for extended periods. Market strategies and optimization directions include: conducting technical upgrades, continuously optimizing image processing technology and audio systems to maintain market leadership; valuing user feedback, collecting user feedback on image and audio quality to specifically improve the product and enhance market competitiveness.

3.4.3. Intelligent and Personalized Services

Intelligent features, such as smart speaker integration, smart recommendation systems, etc., provide personalized services and content recommendations based on

users' viewing habits and preferences. Market strategies and optimization directions include: Data-driven service optimization; utilizing user data analysis to continuously improve the accuracy and effectiveness of intelligent and personalized services; creating market differentiation; emphasizing intelligent and personalized services as a unique selling proposition for the brand, and engaging in differentiated competition with competitors.

In summary, ergonomic factors in the television product market have a significant impact on consumer purchasing decisions and brand loyalty. By deeply understanding and optimizing these factors, and formulating corresponding market strategies and product optimization directions, the market competitiveness and user satisfaction of products can be effectively enhanced.

4. Conclusion and Outlook

4.1. Summary of Research Findings

This paper focuses on the study of human factors in the development of television, emphasizing the important role of television as a household entertainment and information dissemination tool, as well as the significance of human factors in the development of television. Through extensive literature review and in-depth analysis, it was found that the user experience of smart TVs still faces some issues, such as unreasonable user interface design and complex operations. Meanwhile, the application of artificial intelligence technology in the television industry has achieved significant progress, from image quality optimization, voice recognition to content recommendation, AI technology has permeated various aspects of television products. This paper discusses in detail the impact of visual interface design, interaction methods, and user experience design on television user experience, and proposes comprehensive optimization strategies while also proposing the impact of human factors on market competitiveness and corresponding market strategies and optimization directions. This research provides important theoretical support and practical guidance for the design and market strategies of future television products.

4.2. Recommendations and Prospects for Future Television Development

(1) Enhance intelligence and human-computer interaction design: With the development of artificial intelligence and machine learning, future televisions can become more intelligent, capable of providing personalized recommendations and services based on users' habits and preferences. Human-computer interaction design should be more human-centric and intuitive, enhancing the user experience.

(2) Enhance Audio-Visual Experience: Future television display technology should be further upgraded, such as higher resolution, wider color gamut, and higher contrast, to provide a more realistic and immersive viewing experience. At the same time, the audio system also needs continuous improvement to achieve clearer and

more stereoscopic sound effects.

(3) Integrate Multimedia and Cross-Platform Connectivity: Future televisions should support seamless playback of multimedia content and cross-platform connectivity, allowing easy connection to various devices and content sharing, such as smartphones, tablets, and home network devices.

(4) Focus on Ecological Environment and Sustainable Development: During the design and production process, energy consumption should be reduced and the impact on the environment should be minimized. At the same time, the product's lifespan should be extended, its repairability improved, and the generation of electronic waste reduced.

(5) Expand Value-Added Services and Content Ecosystem: Television manufacturers can increase user stickiness by providing rich value-added services and a content ecosystem. For example, collaborate with content providers to offer high-quality video streaming services and personalized advertising pushes.

(6) Enhance Security and Privacy Protection: As intelligent functions increase, televisions need to strengthen security and privacy protection measures to safeguard users' personal information and data security.

(7) Support Future Technology Trends: Such as 5G networks, augmented reality (AR), virtual reality (VR), and enhanced real-time interactive experiences. These technologies will profoundly change the way televisions are used and the user experience.

The future direction of television development is intelligence, high definition, multimedia integration, ecological environmental protection, and security assurance. With technological advancements and changing user needs, the television industry will continue to evolve toward greater intelligence, convenience, and personalization.

References

- [1] GOODMAN, I. F. (1983). Television' s Role in Family Interaction: A Family Systems Perspective. *Journal of Family Issues*, 4(2), 405-424.
- [2] Li Hao, Yue Yue. On the Existential Value of Television Media in the Family in the Internet Era[J]. *Today's Media*, 2017, 25(07): 131-132.
- [3] Li Shengzhi. Developing Children's Family Entertainment Education Industry by Utilizing the Advantages of Television Media[J]. *Television Research*, 2017, (01): 52-54.
- [4] Sun Danping, Jiang Yonggang. Television Entertainment Programs as a Cultural Form[J]. *Mass Literature (Theory)*, 2008, (10): 72-73.
- [5] Chen Xinmin, Ma Tingkui. "Human-Machine Interaction" or "Interpersonal Interaction"? —Multi-dimensional Reflections on the Socialization of Television[J]. *Modern Communication (Journal of Communication University of China)*, 2017, 39(02): 18-22.
- [6] He Miao Long. Discussion on Human-Centered Concept of Modern Television and Human-Computer Interaction Mode[J]. *Electronic Technology and Software Engineering*, 2014, (12): 43-44.
- [7] Wu Tengqi. Several Major Trends in Television Technology Development[J]. *Audio-Visual World*, 2013, (12): 13-16.

- [8] Chen Yong. Development and Latest Advances in Digital Television Technology[J]. Audio-Visual, 2013, (02): 61-62.
- [9] Fei Min. "Present Development of LCD TV Technology." (2003).
- [10] Chen Xinbing, An Zhongwei. Research Progress of Liquid Crystal Materials for Television[J]. Chemical Progress, 2006, (Z1): 246-251.
- [11] Huang Baoying. Exploring the Current Status and Trends of Smart TV Technology at Home and Abroad[J]. Western Radio and Television, 2018, (11): 184+189.
- [12] Sun Peng. Television Enters the Smart Era[J]. Secret Work, 2014, (11): 21-23.
- [13] Liu Hongzhu. Development History of Television and Forecast of Future Development Trends[J]. Modern Information Science and Technology, 2019, 3(06): 37-39.
- [14] Wu Jiang, Zeng Lifeng. Research on Human-Computer Interaction Interface Design of Flat Television[J]. Machine Design and Manufacturing, 2010, (06): 257-259.
- [15] Xie Shihai, Liu Su. A Brief Discussion on Human-Computer Interaction Methods of Smart Television[J]. Science and Technology Information, 2013, (03): 156+206.
- [16] Yun Xiao, Zhao Feng. Emotional Analysis of Smart Television System Interface[J]. Science and Technology Information, 2014, (13): 190+134.
- [17] Lei Shangzhong, Zhang Ruiqiu. Research on Natural Interaction Design of Smart Television[J]. Coastal Enterprises and Technology, 2020, (06): 27-30.
- [18] Qiu Zhaoquan. Research on User Behavior-Oriented Smart TV Interaction Design[D]. Jiangnan University, 2017.
- [19] Hu Zhiyuan. Research on Elderly Smart TV Interface Interaction Design Based on Cognitive Psychology[D]. Shandong University, 2019.