Ergonomic-Based Design for Enterprise Office Space Planning

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Abstract: This paper explores the application background and value of ergonomics in enterprise office space planning and design. It analyzes the role of ergonomic principles in improving employee work efficiency, reducing employee fatigue and occupational risks, enhancing corporate image and culture, and reducing costs. Based on the basic principles of ergonomics, this paper proposes opinions on the content and function of office space and the basic elements of ergonomic theory in office space planning and design. The requirements and standards for enterprise office space planning are summarized, and the shortcomings and problems of current enterprise office design in terms of ergonomic principles are pointed out. Based on the results analysis and problem analysis, this paper proposes the development direction and suggestions for the application of ergonomics in enterprise office space planning and design in the future.

1. Introduction

Office space planning and design for enterprises is a comprehensive project that involves multiple factors, such as work efficiency, employee health, and comfort. Ergonomics, which is the study of the relationship between human structure and function and the environment, is of great significance for office space planning and design for enterprises. The following discusses the application background and value of ergonomics in enterprise office space planning and design:

(1) Improving employee work efficiency: Ergonomics can help enterprises plan and design a more reasonable and comfortable office space, enabling employees to focus more on work and improve work efficiency and quality [1].

(2) Protecting employee physical health: The unreasonable design of enterprise office space often leads to physical discomfort among employees, such as cervical and lumbar diseases. The application of ergonomics can prevent these problems from occurring and protect employees' physical health [2].

(3) Enhancing corporate image: A reasonable and comfortable office space can enhance the image and attractiveness of the enterprise, making employees more willing to stay and work for the enterprise, thereby improving employee job satisfaction and retention rate.

(4) Reducing enterprise costs: Enterprises can use the application of ergonomics to plan a more reasonable office space, reduce employee physical discomfort and illness, reduce employee

absenteeism and medical expenses, and reduce enterprise costs [3].

In summary, ergonomics has important application value in enterprise office space planning and design. It can improve employee work efficiency and physical health, enhance the image and attractiveness of the enterprise, and reduce enterprise costs. Therefore, office space planning and design for enterprises should be based on ergonomics, providing employees with a comfortable, safe, and healthy working environment [4].

2. Basic Principles of Ergonomics

Ergonomics is an interdisciplinary field of knowledge that encompasses various factors such as human anatomy, physiology, behavior, and psychology [5]. The purpose of ergonomics is to optimize the comfort, safety, and efficiency of the human body in different environments, in order to enhance productivity and quality of life. Human anatomy includes the adaptation of the skeleton, muscles, and joints to the human body [6]. Human physiology includes the senses, nervous system, and respiratory system [7]. Human behavior includes movements, postures, and energy consumption [8]. These factors have been extensively applied in the planning and design of corporate office spaces, as evidenced by specific case studies and applications listed below:

(1) Application of Human Anatomy: The height and angle of equipment such as chairs, desks, and computers in corporate office spaces should take into account the employees' body structure to ensure that they do not experience physical discomfort while working [9]. For instance, the height of chairs should match the employee's height, the height of desks should match the employee's arm length, and the height and angle of computers should allow for comfortable and non-fatiguing sightlines. Poor design may lead to diseases such as cervical and lumbar spondylosis, which can affect work efficiency.

(2) Application of Human Physiology: Factors such as temperature, lighting, and air quality in corporate office spaces can affect employees' sensory and nervous functions, thereby affecting work efficiency and physical health. For example, suitable temperature can improve work efficiency, appropriate lighting can reduce visual fatigue, and good air quality can ensure employee health. Poor design may cause employees to experience headaches, eye fatigue, and other issues, which can affect work efficiency. Noise, visual clutter, lack of privacy, and lack of personal space can also lead to a decrease in work efficiency [10].

(3) Application of Human Behavior: The layout, passages, and traffic in corporate office spaces should consider employees' behavioral habits to ensure work efficiency and safety. For example, the width and arrangement of passages should facilitate employees' movement and traffic, traffic facilities should be convenient for employees to enter and exit, and the layout should conform to employees' work processes. Poor design may lead to congestion, collisions, and other issues, affecting work efficiency and safety.

In conclusion, the basic principles of ergonomics are widely applied in the planning and design of corporate office spaces. They can help companies plan and design more rational, comfortable, and safe working environments, improve employees' work efficiency and physical health, and thus enhance corporate productivity and competitiveness.

3. Corporate Office Space Planning and Design

The planning and design of corporate office spaces is a comprehensive process that requires consideration of many factors. Typically, office spaces include entrances, lobbies, reception areas, negotiation areas, meeting rooms, office areas, auditoriums, file rooms, communication rooms, personal workspaces, printing rooms, storage rooms, kitchens, dining areas, and restrooms, based on usage needs. Generally, the entrance, lobby, reception, corridors, and general office areas

represent the core values and brand identity of the company. In addition, facilities such as fitness rooms, game rooms, lounges, pantry rooms, nursing rooms, sleeping areas, and health rooms can be provided to protect employees' physical and mental health and allow for rest and relaxation in the corporate office spaces. The following Table 1 shows the space content and functions required by the enterprise office space:

Table 1: The content and functions of the space required by the enterprise office space.

Space	Function	Space	Function
Entrance	The entrance is a crucial aspect that reflects the brand identity of the company.	Lobby	The lobby serves as a reception area, waiting area, and leisure area, where visitors can relax and enjoy refreshments while waiting to meet with company representatives.
Reception	The reception area enhances the core values and brand image of the company, reflects the company's vision and information, and serves as a primary point of contact for visitors.	Negotiation Area	The negotiation area provides a pleasant environment where people can feel relaxed and comfortable, allowing for easier business negotiations.
Meeting Room	The meeting room must be equipped with the latest technology, including screens, projectors, video conferencing, whiteboards, and other necessary equipment to cater to the unique needs of the company.	Office Area	The office area is the primary workspace for company employees.
Auditorium	The auditorium is used for various activities, such as meetings, speeches, reports, press releases, multimedia teaching, training, and movie screenings. It offers excellent sound quality, clear picture display, and centralized control.	File Room	The file room collects and stores company records and related documents.
Communication Room	The communication room is a closed space for personal communication, such as telephone calls, for employees.	Personal Workspace	The personal workspace is a semi-closed area where employees can concentrate on their work.
Printing Room	The equipment area is an essential functional area in the office, ensuring smooth and efficient work. It should be evenly distributed in the office area and equipped with complete equipment, such as printers and copiers, to handle high-volume demand. The materials should be durable and easy to maintain.	Storage Room	The storage room stores office equipment and files, and the materials used should be durable and easy to maintain.
Kitchen	The kitchen provides all employees with cooked and cold food and beverages. The materials used should be durable and easy to maintain.	Dining area	The dining area offers fast food to all employees and is usually located in a convenient location. The materials used should be durable and easy to maintain.
Restroom	The restroom is a necessary space in the office area.	Fitness Room	The fitness room is a closed space for employees to use for exercise.
Game Room	The game room is a closed space for employees to use for entertainment purposes	Lounge	The lounge area should be bright, fresh, with vibrant colors, friendly, and have a touch of life.
Pantry	The pantry's function has exceeded that of providing a fridge and sink. The pantry also serves as an informal meeting space; therefore, it must be adequately equipped.	Nursing Room	The nursing room is a private and quiet space to meet the mother's breastfeeding needs.
Sleeping Room	The sleeping room is a closed or semi-closed space for employees to rest or take a short nap during work hours or overtime.	Health Room	The health room is a closed space for medical purposes such as emergency treatment, disease screening, vaccination, etc.

The following are the basic elements that should be considered in the planning and design of office spaces in companies, in conjunction with the principles of ergonomics:

(1) Space Layout: The space layout is the core element of the planning and design of office spaces in companies [11]. A reasonable space layout should consider factors such as the work processes of employees, their work habits, and interpersonal relationships. For example, the technical department should be adjacent to the research and development department, and meeting rooms should be located in the central area of the office space. At the same time, the space layout should fully utilize the available space resources, provide employees with sufficient workspace and

personal space, and avoid overcrowding.

(2) Furniture Arrangement: Furniture arrangement is an important aspect of the planning and design of office spaces in companies [12]. A reasonable furniture arrangement should consider the employees' body structure and behavioral habits and provide a comfortable working environment. For example, chairs and tables that conform to ergonomic principles should be selected to reduce pressure on employees' neck, shoulders, waist, back, etc. The height and width of the table should be able to accommodate employees' work tools.

(3) Lighting Design: Lighting design is another important aspect of the planning and design of office spaces in companies. Reasonable lighting design should consider employees' visual health and work efficiency. For example, the brightness and color temperature of lighting fixtures should match employees' visual needs, avoiding eye fatigue and visual impairments.

(4) Temperature Control: Temperature control is a necessary aspect of the planning and design of office spaces in companies. Reasonable temperature control should consider employees' physical health and work efficiency. For example, in the summer, air conditioning temperatures should be controlled within an appropriate range to avoid employees feeling excessively cold or hot.

(5) Acoustic Privacy: In the planning and design of office spaces in companies, attention should be paid to employees' acoustic privacy [13]. Privacy not only relates to personal communication but also may cause co-workers to be distracted. Distraction is usually caused by employees inadvertently overhearing conversations that can be clearly understood. Several methods can reduce the spread of acoustic privacy in office spaces, such as construction methods, acoustic ceiling systems, the type and location of system furniture, and sound masking systems.

In the planning and design of office spaces in companies, ergonomic principles should be applied to every element. For example, space layout should consider employees' work processes and interpersonal relationships, which requires determining the size and arrangement of employees' workspaces and personal spaces based on ergonomic principles. Furniture placement should consider employees' body structure and behavioral habits, which requires selecting and placing furniture based on ergonomic principles. Lighting design should consider employees' visual needs, which requires setting the brightness and color temperature of lighting fixtures based on ergonomic principles. Temperature control should consider employees' physical health and work efficiency, which requires controlling temperature and humidity based on ergonomic principles. Acoustic privacy should consider the sound insulation effect of office spaces, which requires designing sound insulation schemes based on ergonomic principles. Such planning and design make employees feel comfortable, safe, and healthy while working, improving employees' work efficiency and productivity.

4. Review of Requirements and Standards for Enterprise Office Space Planning

4.1. Planning Requirements

4.1.1. Objective Requirements

Office space planning should meet objective requirements, including building conditions, such as bright lighting, unobstructed views, good ventilation, and easy access. At the same time, office space must comply with fire regulations, that is, meet the national requirements for fire evacuation numbers and evacuation route requirements [14].

4.1.2. Subjective Requirements

Office space planning should meet people's subjective needs, which include people's activity

characteristics and objective needs for the environment. In terms of activity characteristics, office space should first meet the characteristics of the enterprise, that is, the company's own management habits and the problems encountered in the actual use of previous office space requirements.

4.2. Planning Standards Review

Table 2: Office Space Planning Standards Table.

Region	Project	Recommended Standards
Office Area	Depth required for one person's seat	550 mm
	Width required for one person to pass through facing forward	600 mm
	Width required for one person to pass through sideways	300 mm
	Distance between back-to-back workstations in straight rows (desk to desk)	1800 mm (recommended not to exceed 2000 mm)
	The distance between the corridor/desk and the wall between the horizontal and vertical stations	≥1600 mm (400 mm for one person standing + 600mm for office chair depth + 600 mm for one person to pass through)
	Distance between main aisles (both sides are walls)	≥2600 mm
	Distance between main aisles (one side is a wall)	2100 mm
	Distance between workstations aisle	1500-1800 mm
	Distance between the workstation and the middle aisle of the file cabinet,when there is a file cabinet placed in the rear	≥1650mm (450mm for cabinet door width + 600mm for office chair depth + 600mm for one person to pass through)
	Maximum number of workstations in a single row	Should not exceed 5. If exceeded, it is recommended to set aisles on both sides with a width of ≥1200mm
	Principles of arranging workstations along walls/columns/windows	Workstations are recommended to be set with a certain aisle (1200-1300mm) between the wall/column/window for employee activities or for adding workstations later
	Location of lighting switches	Set switches on nearby walls/columns and cover a range of 3-6 meters
	Configuration ratio of electronic lockers (for employees' personal storage)	Based on the current trend of mobile office, it is recommended to reserve an additional 10% locker space based on each workstation to meet temporary needs or for use by external visitors
Conference Room	Depth required for one person's seat	700mm
	Width required for one person's seat	800mm
	Distance from conference table to screen (projector, ≤120 inches)	≥1500mm, recommended to be 1800mm if projection area is larger/spatial position is sufficient
	Distance from conference table to wall (for floor-standing TV/monitor)	800mm (comfortable viewing distance near the projection area 400mm + rear bracket 400mm)
	Distance from conference table to wall (for wall-mounted TV/monitor)	600mm (comfortable viewing distance near the projection area 400mm + wall-mounted width 200mm)
	Distance from main seat to back wall (table to wall)	≥1500mm. If more personnel need to pass behind the main seat, it can be increased appropriately
	Distance from side seat to wall (table to wall)	≥1300mm (depth required for one person's seat 700mm + width required for one person to pass through facing forward 600mm)

Detailed mathematical analysis of various areas of office space has been conducted according to ergonomic principles, and the resulting data has been tested by the authors to meet the basic needs of the human body. Therefore, this table of data can be used as a reference when planning office space.

The above Table 2 provides a summary of recommended standards for office space planning.

These standards are designed to ensure a comfortable and safe working environment for employees. The recommended dimensions for workstations, aisles, and other areas are based on ergonomic principles and are aimed at maximizing space utilization while minimizing potential hazards. Lighting switches and electronic lockers are also included in the standards to improve convenience and security. The above table provides recommended standards for the design of meeting rooms. The dimensions of the meeting table, screen, and distances from the table to the wall are based on ergonomic principles and are designed to create a comfortable and efficient working environment for meeting attendees. The recommended dimensions for seats are also based on ergonomic principles and aimed at maximizing the use of space while ensuring the comfort of attendees. Overall, adherence to these standards can help create a more efficient and productive office space.

5. Discussion and Conclusions

Ergonomics has significant application value in the planning and design of enterprise office spaces. By applying ergonomic principles in a reasonable manner, it is possible to improve employee work efficiency and productivity, reduce fatigue and occupational health risks, enhance corporate image and culture, and lower recruitment and training costs, among other benefits. However, there are still some shortcomings and issues in the application of ergonomic principles in enterprise office space planning and design. For example, some enterprises still have designs that do not conform to ergonomic principles, such as unreasonable office space distances and unsuitable table and chair heights, inadequate or excessive lighting, among others. Additionally, enterprises face challenges during implementation, such as considering employee personal preferences and the unique requirements of different job positions.

Therefore, further research and promotion are needed in the application of ergonomics in the planning and design of enterprise office spaces in the future. Enterprises need to fully recognize the application value of ergonomics, improve their awareness and ability to apply ergonomics in office space planning and design, and provide employees with a more comfortable, safe, and healthy work environment through scientific methods and technologies.

The development direction of enterprise office space planning and design based on ergonomic theory in the future is suggested as follows:

(1) Strengthen the popularization and promotion of ergonomic knowledge, and improve the recognition and understanding of ergonomic principles among enterprise employees.

(2) Fully consider the needs and habits of employees in office space planning and design, and develop personalized design schemes that conform to each employee's requirements.

(3) Adopt advanced technologies, such as virtual reality and human simulation technology, to simulate and test the office space, and improve the accuracy and reliability of the design scheme.

(4) Give more consideration to the needs and special requirements of employees in different job positions, and develop targeted design schemes.

(5) Continue to research and innovate in ergonomics, and constantly promote the application and development of ergonomics in the planning and design of enterprise office spaces.

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