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Status and Analysis of Mouse and Keyboard Ergonomic Design Products

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Abstract: This study aims to explore the current status and analysis of mouse and keyboard ergonomic design products. For mice and keyboards, explain the current status of their products, analyze their problems and propose solutions through the current widely used mice and keyboards, and look forward to their future development trends. Through this research, we can better understand the current state of ergonomic design of mice and keyboards, analyze their strengths and weaknesses, and provide ideas and directions for future design. This study has certain practical significance for improving the human-computer interaction experience of mouse and keyboard products.

Keywords: Ergonomics, Mouse, Keyboard.

1. Introduction

With the rapid development and popularization of computer technology, the demand for the mouse and keyboard as the main input devices of the computer is also getting higher and higher. Mouse and keyboard play a very important role in daily life and work, but are often neglected by users. However, prolonged and frequent use of non-ergonomic mice and keyboards may lead to a series of health problems and reduced work efficiency.

Firstly, prolonged use of an unsuitable mouse may lead to discomfort and fatigue in the hands and arms. Traditional mouse shapes and sizes do not fit everyone's hand shape and hand size, which may lead to an unnatural posture of the hand, which over time can lead to hand muscle fatigue, tendonitis and other problems. In addition, the layout of the mouse buttons and the touch-sensitive technology may not be ergonomic, making it necessary for the user to exert too much force during clicking and swiping, increasing the burden on the hands.

Similarly, the inappropriate design of keyboards can also cause inconvenience and discomfort to users. The layout and keycap design of traditional keyboards usually do not conform to the natural curves of the human hand, resulting in overextension and flexion of the fingers on the keyboard, which can easily lead to finger fatigue and joint problems. In addition, keyboard heights and angles that are too high or too low can cause hand and wrist discomfort. Lack of wrist rests or hand cushions can also lead to hand discomfort and wrist sprains.

The purpose of this study is to improve the comfort and efficiency of the human-computer interaction experience by conducting an in-depth study of the ergonomic design of mice and keyboards, analysing the current situation and searching for solutions to improve it.

By studying the ergonomic design principles and standards for mice and keyboards, guidance can be provided to manufacturers and designers to help them design ergonomic products. This will help improve user comfort and reduce hand and arm strain when using mice and keyboards, thereby reducing hand muscle fatigue and related health problems. Analyzing common mouse and keyboard problems and solutions can provide users with specific usage guidelines and recommendations to help them choose the right mouse and keyboard products for them, thus reducing discomfort and injury during use.

This study also has important implications for health and labour protection. Long-term use of non-ergonomic mice and keyboards may lead to hand muscle fatigue, tendonitis and other occupational diseases. By studying and improving the ergonomic design, the incidence of these occupational diseases can be reduced and the health of users can be protected. By studying the ergonomic design of mice and keyboards, we can continue to promote technological innovation and design progress, and provide practical guidance for the development of human-computer interaction technology. This will help promote cutting-edge research and applications in the field of human-computer interaction and contribute to the future development of science and technology.

In addition to the impact on individual users, improvements in mouse and keyboard ergonomics can help improve efficiency and productivity. Comfortable mouse and keyboard design can reduce the user's physical burden, reduce fatigue, and improve work efficiency. Improving work efficiency not only saves time and energy for individual users, but also improves the work efficiency and competitiveness of the whole organization or enterprise on a wider scale.

In summary, through in-depth study of ergonomic design of mouse and keyboard, not only can it improve user experience and work efficiency, but also has important significance for health protection and promotion of scientific and technological innovation.

2. Ergonomics Related Theories

(1) Definition of ergonomics

Ergonomics is the scientific discipline that studies the interrelationships between human beings and their work environments with the goal of improving efficiency, safety, and comfort. It involves designing, evaluating, and improving work environments, tools, equipment, and tasks in ways that

accommodate human physiological and psychological characteristics. The core concept of ergonomics is to place human needs and abilities at the centre of design and to match work environments and tasks to human abilities, limitations and preferences in order to promote efficiency and quality of work.

Ergonomics focuses on aspects of human posture, movement, strength and perception, and examines how to optimise the layout of work environments, the design of tools, the scheduling of work tasks, as well as aspects of training and education, in order to reduce work-related risks and injuries, and to improve work efficiency and user satisfaction. It has a wide range of applications in a variety of fields, including offices, factories, transport, medical equipment, computer interface design, and more.

The goal of ergonomics is to promote individual and organisational development and health by combining knowledge from a number of fields, including engineering, psychology, physiology and social sciences, to create a better match between a person and the work environment, and to improve work efficiency, safety and human comfort.

(2) Research content and methods of ergonomics

The study of ergonomics is very broad and covers many aspects. Here are a few important research components of ergonomics:

Human-computer interface design: the study of how people interact with computers, machines, and other technological devices in order to improve the user's ease of operation, efficiency, and satisfaction. This includes the design of easy-to-use user interfaces, ergonomic keyboards, mice, and touch screens.

Workplace design: the study of how work environments are designed and arranged to best suit human needs and abilities. This includes the design of workstations, seating, lighting, noise control and climate regulation to provide a comfortable, safe and healthy working environment.

Labour physiology: the study of the human body's physiological responses and capabilities at work. This involves the study of human posture, muscle activity, force exertion, and fatigue to determine the effects of work postures and workloads on the human body in order to improve work efficiency and prevent occupational diseases.

Anthropometrics: The measurement of parameters such as human size, body shape and range of motion to provide a basis for ergonomic design. This includes techniques and methods for measuring human dimensions, as well as statistical and computer simulation tools for analysing data on human dimensions.

Mannequin and simulation: Mannequin and computer simulation techniques are used to model and evaluate the effects of different work postures, tasks and work environments on the human body. This helps to predict potential ergonomic problems and optimise design solutions.

Ergonomics is the study of the relationship between the human body and the work environment, with a primary focus on how work environments and work tasks can be designed to promote human health, safety and efficiency. When studying ergonomics, there are a variety of methods that can be used to collect and analyse data to understand how the human body performs and reacts to specific work tasks. The following are some common ergonomics research methods:

Field observation: ergonomic data is collected through direct observation of the workplace and work tasks. The observer can record information about the worker's posture, movement, force use and work load.

Questionnaire surveys: information is collected by distributing questionnaires to workers to understand their perceptions and experiences of the work environment, work tasks and physical discomfort. Questionnaires quantify subjective feelings and provide researchers with a wealth of data.

Biometrics: Biometric tools are used to obtain objective data on workers' physical responses. For example, heart rate monitors can measure heart rate variability and skin conductance measurements can assess psychological stress levels.

Mannequin and simulation: Computer modelling and simulation techniques are used to simulate human behaviour and reactions in a variety of work environments and tasks. This approach predicts human posture, force use and kinematic parameters.

Functional assessment: Assessing the function and capabilities of the human body by performing specific tasks. For example, strength testing instruments are used to assess a worker's muscular strength and endurance.

These methods can be used individually or in combination to provide comprehensive ergonomic research data to help improve work environment and task design, productivity and worker safety.

(3) The role of ergonomics in mouse and keyboard

The content of ergonomics research and its role in mouse and keyboard design can be summarised as follows:

Ergonomics determines the static and dynamic dimensions of the human body through methods such as anthropometric measurements and mechanical analyses, and researches human characteristics and operational performance. By testing the limits of human strength and reach, ergonomics provides a scientific basis for product design and space planning of the "man-machine-environment" system. In the design of mice and keyboards, these dimensional parameters are very important because they directly affect user comfort and operating efficiency. By reasonably determining the size and shape of the mouse and keyboard, so that it conforms to the human body parameters, so that the user in the operation process can be easy, natural use, reduce unnecessary fatigue and discomfort.

Ergonomics provides a scientific basis for the functional design of the mouse and keyboard. By analysing the interrelationship between man and object, ergonomics can maximize the optimization of the mouse and keyboard in all aspects of function, so that it is consistent with the human physiology, psychological function. For example, ergonomics can study the human hand movement characteristics, to determine the most suitable for finger movement of the key layout and the number and location of mouse buttons. The mouse and keyboard designed in this way can be better adapted to the user's operating habits, improve the user's reaction speed and operational accuracy.

Ergonomics also provides a workflow for adhering to the "human" as the core design ideas. In the whole process of product design, always put "people" in the core position is the basic principle of ergonomics. Ergonomics design in all

stages of product design need to be paid attention to, in order to ensure that the use of the product function can be fully developed. For example, in the process of mouse and keyboard design, ergonomics requires designers to take the user's needs and experience as the starting point in the process of identifying needs, conceptual design, detailed design and product verification and improvement, and continuously improve the product through user testing and feedback.

In summary, the research content of ergonomics and its role in mouse and keyboard design is multi-faceted and comprehensive. By providing reliable human scale parameters, reasonable functional design and adhering to the "human" as the core design idea, ergonomics makes the mouse and keyboard better adapt to the user, and improves the user's comfort, efficiency and experience.

3. Current Status and Analysis of Mouse Ergonomics Design

(1) Product Status of Mouse

Through the Internet on the domestic and international market research, the mouse-related products on the market from the operating position, broadly speaking, can be divided into flat mouse, vertical / tilt mouse, trackball, mouse pen, gaming mouse five categories.

a. traditional mouse: standard such products, palm down, wrapped mouse, through the arm and wrist in the horizontal plane sliding, drive the cursor to move, generally only with the left and right keys and scroll wheel buttons.

b. Vertical or tilt mouse: also known as ergonomic mouse. This type of mouse allows the user to form a certain angle between the palm of the hand and the desktop when in use, rather than the traditional parallel posture. Its purpose is to reduce the arm side deviation angle, and the pressure in the carpal tunnel, relieve the pressure and pain on the wrist, but also to avoid the palm of the median nerve compression. There is a wide variety of vertical and tilting mice on the market today, with different shapes and tilt angles.

c. Trackball mouse: the rotation of the trackball through the finger toggle instead of the movement of the mouse, so that when it is in use, the arm moves less, occupies less space when working, and can relieve hand fatigue to a certain extent. Due to its accurate positioning, it is more used for graphic design or 3D design and other fine operation work, and it is difficult to complete the behaviour of frequent movement.

d. Mouse pen: such products to hold the pen to control the movement of the cursor, and at the same time change the position of the hand force, can be more accurate control of the cursor movement, in the middle-aged and elderly groups, the teaching profession, preachers and other groups are more common. Let the computer input method is not skilled users, there is a new way of input, but also for the board and speech to provide a more convenient way of operation.

e. gaming mouse: gaming mouse is in recent years due to the rich content of the game, the mouse operation requirements to improve, and in the traditional flat mouse on the basis of upgrading. Such as DPI, weight, centre of gravity, auxiliary buttons and other indicators. Ordinary mouse DPI value is relatively low, generally are 400 to 600, and can not be adjusted. The DPI value of the gaming mouse is very high, basically are thousands, and can be adjusted.

(2) Mouse Shape and Hand Posture Adaptability

As one of the most commonly used input devices for computers, the ergonomic design of the mouse is crucial for user comfort and work efficiency. However, in practice, there are some problems with common mouse designs, such as irrationalities in size, shape, button layout and weight. This part will analyse these problems and propose corresponding solutions.

Many mice are not sized and shaped to fit all users' hand shapes and hand sizes. Mice that are too large or too small may be difficult for users to hold comfortably, leading to hand fatigue and discomfort.

To address improperly sized mice, manufacturers should offer multiple size options for mice. In this way, users can choose the right mouse for their hand size for a better grip and operating experience. Market research and user feedback are very important tools for manufacturers to help them understand the needs and preferences of different users. By collecting user feedback, manufacturers can continually improve the design of their products to provide a mouse that better suits the needs of users.

Designers should also take ergonomics into account when designing the shape of the mouse. This includes taking into account the natural shape of the hand, such as the angle at which the palm bends, the length of the fingers, and other factors. The shape of the mouse should match the shape of the human hand to provide a more ergonomic grip. In this way, the mouse can better adapt to different users' hand shapes and sizes, reducing hand fatigue and discomfort

(3) Optimisation of mouse button layout and touch-sensitive technology

The layout of the mouse buttons may not be ergonomically correct, resulting in the user needing to exert too much force during use, increasing the burden on the hand. The buttons are too prominent or too hidden, which may also lead to inaccurate button operation.

To solve the problem of irrational button layout, designers should reasonably layout the buttons on the mouse so that users can operate them easily and accurately. The position and shape of the buttons should take into account the natural curve of the fingers and the posture of the hand when holding the mouse, in order to enable users to use the mouse buttons more naturally.

Firstly, the position of the buttons should conform to the natural curve of the fingers. In this way, the user does not need to move his/her fingers too much when using the mouse and can operate the buttons more easily. Secondly, the shape of the buttons should also match the curve of the fingers to provide a better sense of touch and grip. In this way, users can sense the position of the buttons more accurately when using the mouse, thus improving the accuracy of button operation.

In addition, designers can use touch-sensitive technology to improve the button layout. By replacing physical buttons with touch areas, users can operate without physical buttons. Touch-sensitive technology can provide more flexible and precise operation, enabling users to tap, swipe and other operations more easily, thus reducing the burden on the hand.

(4) Relationship between mouse weight and grip comfort

The weight of the mouse also affects the user's experience. An overweight mouse may increase the burden on the arm, causing discomfort when used for a long time; A mouse that is too light can cause the user to lose control when

manipulating.

Designers should pay attention to the weight of the mouse so that it can provide a stable control feeling without being too heavy or too light. By choosing the right material and adopting a reasonable weight distribution, the balance and comfort of the mouse can be achieved.

First, for overweight mice, designers can use lightweight materials, such as high-strength plastics or aluminum alloys, to reduce overall weight. At the same time, by optimizing the internal structure and layout, the weight is distributed reasonably to make it more balanced. In this way, the user does not have to bear too much arm burden during use, reducing the discomfort of long-term use.

For mice that are too light, designers can consider adding appropriate weight to provide a better sense of control. An appropriate amount of metal or other heavy objects can be added inside the mouse to increase the overall weight of the mouse. This can increase the user's sense of stability during control, and avoid the situation of too light mouse causing the operation to be out of control.

In addition to weight designs, manufacturers can also offer mice with adjustable weight. By designing adjustable physical weight blocks inside the mouse, users can adjust the weight of the mouse according to their preferences and needs for a personalized control experience. This design can provide better flexibility to meet the needs of different users.

(5) Human-computer interaction experience with the mouse

Many mouse products lack innovation and breakthroughs in design to provide a surprising and enjoyable human-computer interaction experience. Limited to traditional design ideas, these mice cannot fully meet the expectations and needs of users, and cannot bring an experience that keeps pace with the times.

To provide innovative human-computer interaction experiences, manufacturers can consider the following design ideas:

Introduction of touch and gesture operation: Combining touch sensing technology and gesture recognition technology, the mouse has the ability of multi-touch and gesture operation, providing a more intuitive and flexible way of interaction.

Combining virtual reality (VR) and augmented reality (AR): Combining a mouse with a virtual reality or augmented reality device provides a more immersive, interactive experience that allows users to operate freely in a virtual environment.

Bluetooth and wireless charging technology: Using Bluetooth connection technology, the mouse does not need to be connected to the computer, providing more flexibility and convenience. At the same time, wireless charging technology is applied to realize the wireless charging function of the mouse and get rid of the trouble of battery replacement.

Intelligent design: Apply artificial intelligence technology to mouse design, so that it can adapt to the habits and needs of users, and provide personalized operation and recommendation functions. For example, by learning the user's habits and behaviors, the smart mouse can automatically adjust the sensitivity and cursor speed, providing a smoother and more efficient operation experience.

(6) Future trends in mouse ergonomics

With the continuous advancement of technology and the demand of users for a better experience, the ergonomic design of the mouse will continue to evolve and innovate. Here are a few aspects of the future of mouse ergonomics:

a. Personalized design: With the increasing demand for personalization and customization, the ergonomic design of the mouse will also develop in the direction of personalized design. Manufacturers can provide personalized design choices based on factors such as the user's hand size, hand posture, and operating habits. This can help users get a more comfortable and personal mouse that meets their needs, improving the accuracy and efficiency of operation.

b. Posture sensing technology: Traditional mouse use requires hand movement on a flat surface, but with the development of posture sensing technology, future mice can track the three-dimensional movement of the hand. This means that users can move their hands freely in the air, not just flat surfaces. This new technology will reduce pressure on the wrist and arm, providing a more natural and comfortable experience.

c. Eye tracking technology: Eye tracking technology has found a wide range of applications in the field of virtual reality and augmented reality, and may be applied to mouse design in the future. With eye tracking technology, users can control the cursor simply by looking at where the mouse is located without actually moving their hand. This will be especially beneficial for those users who suffer from hand movement disorders or need to process large amounts of data for long periods of time.

d. Brain-computer interface technology: Brain-computer interface technology is developing rapidly, which allows people to control computer devices through thinking. Future mouse designs may integrate brain-computer interface technology to enable users to operate the mouse directly through brain signals, providing a more direct, efficient and convenient way to operate.

e. Intelligent and adaptive design: The future mouse ergonomic design is expected to tend to intelligent and adaptive design. By integrating sensors and intelligent algorithms, the mouse can detect the user's hand posture and comfort in real time and automatically adjust and optimize it according to the user's needs. For example, a smart mouse can automatically adjust the sensitivity and weight of the mouse based on the user's hand fatigue, providing a more comfortable and adaptable operating experience.

These developments will improve user comfort and productivity, and make the mouse more tailored to the user's individual differences and needs.

4. Keyboard Ergonomic Design Product Status and Analysis

(1) Product Status of Keyboards

a. Slot keyboards. Slot keyboard is a key to a symbol of the keyboard, the standard keyboard all key rows are in the same plane, while the slot keyboard will be the third row (i.e., ZXCVB rows) keys and the entire keyboard plane into a 90 ° arrangement, the entire keyboard shape from the side of the formation of a groove, so it is called a slot keyboard. Its characteristics are: ① basic key layout has not made fundamental changes; ② slot design simplifies the operation from the 2nd line (i.e., ASDFG line) keys to the 3rd line of keys, which is conducive to improving the speed of input and

reduce the load on the fingers; ③ the distribution of the keys between the basic rows of the key distribution is designed as a one-to-one linear arrangement, which is conducive to improving the ease of learning, accuracy and speed of blind typing input; ④ in the inner edge of the keyboard (A fixed armrest is designed at the inner edge of the keyboard (near the operator). Related research results show that the slot keyboard is better than the standard keyboard in terms of input speed, accuracy, ease of learning and reducing operator fatigue.

b. Chord keyboard. Chord keyboard is a multi-key keyboard, input a unit of information must be pressed at the same time one or several keys, just like the piano to play harmony, so it is called chord keyboard. It has the following characteristics: ① small size, can be easily carried; ② input speed is high; ③ easy to learn; ④ flexible operation: can be operated by one hand or two hands. Due to the above reasons, chord keyboards are regarded as the most powerful tool that can replace standard keyboards in foreign countries.

c. Ergonomic keyboard. As early as 1926, Klockenberg used the traditional QWERTY keyboard with extremely unnatural hands. So he split the keyboard into left and right halves and designed the original ergonomic keyboard (i.e., the K-keyboard). It is characterised by the standard keyboard on the fingering of the left-handed key area and the right-handed key area of the two plates left and right separated from the middle of the hinge connected, left and right-handed use of a piece of the K keyboard, each piece of the K keyboard are placed at a certain angle, so that people do not have to consciously tighten the arms, to maintain a more natural state of the wrists naturally straighten the operation of the natural, not easy to fatigue. Experiments show that there is no difference between the K-keyboard and the QWERTY keyboard in terms of typing speed and efficiency, but the user of the QWERTY keyboard stops typing due to the pain in the wrists, while the user of the K-keyboard stops typing due to the fact that he/she can no longer concentrate on his/her work.

d. General keyboards. Including mechanical keyboards: there is a separate axis body, through two spring contacts, to trigger the signal, relatively expensive. Its working principle is to make the contact conduction or disconnection, it has a simple process, noise, easy to maintain, and allows you to type with a strong sense of rhythm, so that you can use it for a long time will also feel comfortable in terms of the hand will also feel very comfortable. Plastic film type keyboard: generally there are three layers of internal circuit boards, the upper and lower layers are circuit boards, the middle is an insulating layer, the keyboard is pressed, through the first layer and the third layer of contact, triggering the signal. And it also has a very important feature is the low price, low noise and low cost, but this kind of product if you use for a long time due to the material problem will make your hand feel change. Conductive rubber keyboard: first of all, you have to understand the structure of the contacts it is connected through the conductive rubber. Wired keyboards and wireless keyboards: wired keyboards generally have a high degree of flexibility in performance, fast response, and wireless keyboards are generally used for business office, wireless keyboards are generally not too flexible response, suitable for office a family and home, gamers are generally not used. Backlit keyboard and non-glowing keyboard: the general backlit keyboard is the game with cool lights, but power consumption is a little higher than the usual keyboard, the other is about the same. Backlit keyboards are also called LED-illuminated keyboards.

(2) Optimisation of keyboard layout and keycap design

As one of the main input devices of the computer, the ergonomic design of the keyboard plays a vital role in the user's comfort and work efficiency. However, there are some problems with common keyboard designs, such as irrationalities in keyboard layout, keycap shape, key travel, and hand rests. This section analyzes these problems and proposes solutions.

Keyboard layout and keycap design have a significant impact on the efficiency and comfort of the user's keyboard. However, there are some issues with the existing keyboard design. First of all, the QWERTY layout is the most common keyboard layout, but there are historical reasons for its design and it is not necessarily the most ergonomic to the maximum. Secondly, in terms of keycap design, the shape and size of some keycaps may not conform to the pressure distribution of the fingers, resulting in uncomfortable buttons.

In terms of keyboard layout, consider a more ergonomic layout such as the DVORAK layout. DVORAK layout is dedicated to reducing the distance of finger movement and improving typing efficiency. In addition, according to the user's typing habits and needs, personalized keyboard layout options can be provided, such as software or mechanical keyboards that can customize the keyboard layout.

In terms of keycap design, the shape and size of keycaps can be redesigned according to the pressure distribution of fingers and the position of commonly used keys. For example, by adding grooves or bumps to frequently used keys, you can provide a better feel and guidance. In addition, the use of ergonomic materials such as rubber or silicone keycaps can increase the comfort and slip resistance of the keys.

(3) Importance of keyboard height and angle adjustment

Adjustments to keyboard height and angle are essential to reduce the burden on the hands and wrists. However, in many common keyboards, the height and angle of the keyboard are fixed and cannot be adjusted to the user's needs. This can lead to unnatural or twisted postures of the user's hands and wrists when using the keyboard for extended periods of time, increasing the risk of muscle fatigue and injury.

To solve the problem of keyboard height and angle, keyboard brackets with adjustable height and tilt angles are available. Users are free to adjust the height and angle of the keyboard according to their needs, so that it maintains a natural posture with the arms and shoulders. In addition, for professional users or those who need to use the keyboard for a long time, you can also consider a keyboard table equipped with electric or pneumatic adjustment to further provide personalized keyboard height and angle adjustment.

(4) Balance of key strength and feedback on the keyboard

Keyboard key strength and feedback play an important role in the user's typing speed and comfort. However, in existing keyboard designs, key force and feedback often do not meet the needs of all users. Some keyboard keys are too light and easy to touch by mistake; Some keys are too heavy and require too much effort to use. In addition, inconsistent keyboard feedback or lack of tactile and auditory feedback can reduce the user's typing accuracy and comfort.

To solve the problem of key force and feedback, an adjustable key force mechanism can be used. Users can adjust the key strength according to their own needs to achieve a

comfortable experience. In addition, button designs with built-in springs or electronic sensors can be used to provide more consistent and adjustable key feedback through different force changes and trigger mechanisms. For example, adjustable spring or capacitive button designs allow users to adjust the tactile feel and feedback strength of the keys to their liking and needs. In addition, with the right shape and material selection, such as the use of keys with rubber pads, it can provide better haptic feedback and reduce key noise. At present, some mechanical keyboards are divided into different axes, and their different axes can give users different key feedback.

(5) Role and design points of hand cushions and wrist rests for keyboards

Keyboard hand cushions and wrist rests provide additional support and reduce pressure on the hands and wrists. However, some keyboards have hand cushions and wrist rests that are not designed properly or lack comfort. Hand cushions and wrist rests have a small support area that does not adequately support the user's hand. At the same time, the height and angle may not match the position of the user's arms and shoulders, resulting in excessive extension or twisting.

In order to optimize the design of hand cushions and wrist rests, the following points need to be considered. First of all, hand cushions and wrist rests should have sufficient support area to ensure that the hand can be evenly supported and reduce the pressure on the hand. Second, the height of the hand cushions and wrist rests should be consistent with the user's natural posture of the arms and shoulders, avoiding overextension or twisting. Hand cushions and wrist rests with adjustable height and tilt angles can be used to meet the needs of different users. In addition, the material chosen should be soft and comfortable, providing sufficient support and shock absorption.

In addition, in order to further improve the user's comfort, the ergonomic full hand support design can be considered. The fully supported design means wrists, palms and fingertips are supported, reducing pressure on all areas. Hand support can be designed using soft materials such as artificial leather and memory foam, and it can be reasonably divided and filled according to the shape and curve of the hand to provide a better fit support.

(6) Future trends in ergonomic design of keyboards

a. Flexible keyboard: Future keyboard designs may use flexible materials that enable the keyboard to be adaptively adjusted according to the shape and posture of the user's hand. Flexible keyboards reduce hand strain and discomfort and provide a more personalized and comfortable typing experience.

b. Touch and gesture recognition technology: Future keyboard designs may integrate touch and gesture recognition technology, enabling users to complete input operations through finger touch and gestures. This will make the keyboard more compact, reduce the number of physical keys, and provide a more intuitive and natural way of operating.

c. Pulse keyboard: Pulse keyboard is a keyboard that can adjust key strength and feedback. In the future, pulse keyboards may be further developed, adjusting the sensitivity and trigger force of the keys according to the user's needs and preferences. This will increase the user's input speed and accuracy, and reduce hand fatigue and injury caused by excessive force applied to the keys.

d. Adjustable angle and height: Future keyboard designs may focus on the adjustable angle and height of the keyboard to ensure that the user's wrists and arms maintain a natural posture. The keyboard may be equipped with adjustable support brackets or angle adjustment devices to suit different users and usage environments.

e. Biometrics: Biometrics, such as fingerprint recognition or iris recognition, may be applied to future keyboard designs. This will enhance the security of the keyboard and provide users with a more convenient way to authenticate.

The application of these technologies will improve the adaptability, comfort and user experience of the keyboard, making the keyboard more suitable for individual differences and needs.

5. Conclusion

In this paper, we conduct a comprehensive current situation and analysis of mouse and keyboard ergonomics. Studies have found that the ergonomic design of mice and keyboards, which are critical input devices in computer operation, has an important impact on user comfort, health, and productivity.

For the ergonomic design of the mouse, the product status of the mouse is summarized, and it is found that the mouse has some ergonomic design problems, such as the mismatch between the size of the mouse and the size of the palm, and the mismatch between the shape of the mouse and the hand posture. In response to these problems, we propose corresponding solutions, such as optimizing the mouse button layout and touch sensing technology, adjusting the weight of the mouse, etc. In addition, look forward to the future development trend of mouse ergonomics.

Aiming at the keyboard ergonomic design, this paper summarizes the product status of the keyboard and analyzes the problems of common keyboards, such as keyboard layout, keycap design and keyboard height angle adjustment problems. In response to these problems, we propose optimized solutions, such as improving keyboard layout design, providing keyboard height and angle adjustable functions, etc. At the same time, look forward to the future development trend of keyboard ergonomics.

In summary, the ergonomics of the mouse and keyboard play a vital role in computer operation. Through the analysis of the existing design, we identified some problems and areas for improvement. However, recent mouse and keyboard designs have introduced many new ergonomic features and technological innovations that provide more possibilities for the user's operating experience. In the future, we can expect more personalized and intelligent mouse and keyboard designs to meet the growing needs of users.

However, this paper also has certain limitations. Due to time and space constraints, we are unable to exhaustively explore all mouse and keyboard ergonomic design problems and solutions. Future research could further explore the individual needs of specific populations and the impact of developments in emerging technologies and application environments on the ergonomics of mice and keyboards.

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