# Design of Sitting Posture Correction Desk-chair Product Based on Fogg's Behavior Model

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**Abstract.** Guided by the Fogg's Behavior Model (FBM) theory, this paper designs a desk-chair product for effective posture correction by guiding users' operational behaviors. The paper employs a literature review and survey methodology to analyze the current state of posture correction in relevant domains. Leveraging the Fogg's Behavior Model theory, a user model for the posture correction desk-chair is constructed to guide user behavior. The resulting design integrates a posture monitoring feedback system with a dynamic posture correction mechanism, achieving posture correction by both prompting correct posture maintenance and improving user muscle conditions. By aligning with the Fogg's Behavior Model theory and the product usage workflow, user experience can be enhanced. Based on the Fogg's Behavior Model theory, a posture correction desk-chair product is developed with a posture monitoring system and dynamic correction functions, guiding user behavior and optimizing user-product interaction for enhanced correction efficacy. This design concept introduces novel perspectives to the field of related product design research, offering theoretical insights and practical application references.

**Keywords:** Fogg's Behavior Model (FBM); sitting posture correction; user behavior guidance; user experience; desk-chair product

## 1 Introduction

With the advancement of science and technology and the widespread use of the internet, the frequency and duration of working and studying in a seated posture have continuously increased. The quality of users' seated posture significantly impacts their health and overall quality of life. According to surveys, the prevalence of poor sitting posture in daily work and study has led to severe physical consequences. Consequently, designing corrective solutions for sitting posture has become an urgent concern. Existing research and applications related to posture correction products suffer from issues such as a lack of scientific theoretical foundation and inadequate design. Addressing this array of challenges, this paper draws guidance from postural correction theories and integrates the Fogg's Behavior Model theory. It analyzes the design of posture-correcting desk-chair systems, culminating in an innovative solution that combines posture monitoring feedback with dynamic posture correction. This approach offers a more scientifically effective means of guiding users to improve their behavioral habits and correct their sitting posture.

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### 1.1 Overview of sitting posture correction theory

Posture problems caused by poor sitting posture are mainly related to the parts of the human spine, such as anterior head extension, hunchback, chest rotation and scoliosis, which are usually accompanied by and affect each other.[1] When the major posture problem is corrected, other posture problems will also be improved, thus achieving the overall posture correction effect. Since the hunchback problem is common and typical among the posture problems caused by poor sitting posture, this paper focuses on the correction and improvement design of the hunchback posture problem.

The basic idea of posture correction is to guide the users' behavior to maintain the correct body posture, strengthen the weak muscle groups, and realize the users' self-management in the correction process through the design of operation modes. Specifically, posture correction is completed through the following three aspects.

Firstly, maintain the correct posture. The essence is to maintain the correct position of the skeleton and keep its curvature within the normal physiological curvature, which helps to prevent posture problems at source and prevent the aggravation of poor posture. To achieve this, the factors leading to poor posture should be identified, and the users' poor posture should be detected and corrected in time to eliminate or mitigate its effects. External forces can also be used to force the users to maintain the correct posture. However, such methods cannot fundamentally correct the posture, for they tend to make users dependent and cannot mobilize users' autonomy.

Secondly, strengthen the weak muscle groups. Strong muscles are conducive to maintaining the normal position and range of movement of the joints. For users with serious hunchback problems, the muscles and soft tissues in the anterior part of the body, such as the pectoralis major muscles, contract and become shorter. While the muscles in the posterior part of the body are elongated and the muscle strength becomes weaker, which affects joint activity. Therefore, it is necessary to strengthen the muscle strength of the corresponding parts to achieve the corrective effect. The common methods to enhance muscle strength are: muscle stretching technique, myofascial trigger point inactivation technique, massage, etc.[1] Some of these muscle stretching activities can be completed independently by users. But users are required to ensure the correctness of stretching movements and develop long-term exercise habits.

Thirdly, in the process of posture correction with the help of the above methods, users' autonomy and exercise habits are crucial. Only when users actively cooperate or have good exercise habits can they get a better posture correction effect.

### 1.2 Overview of design research related to sitting posture correction

This paper collects and sorts out the existing information, summarizes and analyzes the design ideas of sitting posture correction in the following aspects.

#### 1.2.1 Improve the sitting posture monitoring and feedback system.

By monitoring users' sitting posture in real time and providing feedback, users can keep abreast of their sitting posture and correct poor sitting posture in a timely manner. The technologies used for sitting posture monitoring mainly include sensors and visual recognition. Among them, the sensor-based sitting posture monitoring system has high accuracy and is widely used in design research.[2-4]However, due to the complexity of the equipment required and the difficulty of operation, it has not been widely used in production practice. In response to these problems, some scholars have designed a more convenient sensor-based sitting posture monitoring system by improving the sensor material to optimize the sensor performance.[5, 6] In conjunction with the sitting posture monitoring, the sitting posture feedback system detects users' poor sitting posture and sends alerts to users in the form of images, sounds, flashing lights or vibrations. Image feedback allows users to intuitively and comprehensively understand their own sitting posture, clarify the problem and correct it in a targeted way. However, the above forms of prompts often interrupt users' thinking. Frequent prompts may make users rebellious and then ignore or defy the prompts, which will weaken the effect.

Sitting posture monitoring and feedback system helps users identify their own sitting posture problems and correct them independently, so as to maintain the correct sitting posture and prevent bad posture. However, the system lacks significant correction effect for users who already have posture problems because it does not improve users' weak muscle groups. Secondly, as the system only provides feedback, the maintenance of good sitting posture relies on users' autonomy. The lack of guidance on user behavior is not conducive to users' adherence to use and develop good sitting posture habits. Finally, the immature technology and equipment have a great impact on the user experience and need to be further optimized.

### 1.2.2 Change the stress mode of sitting posture.

The sitting furniture is designed to change the force of users' various parts of the body in the sitting posture, so that the body can be naturally straight and the spine can reach normal physiological curvature. Kneeling chairs and saddle chairs are representative products that can improve users' sitting posture by changing the force.[7]Zhou, J. F. et al.[8] designed a gravity-driven posture correction device and verified its effectiveness through experiments. This kind of force-altering posture correction design can make users naturally maintain the correct sitting posture and effectively change their behavior. On the other hand, such design research is difficult and not easy to ensure its scientificity and effectiveness.

### 1.2.3 Force the torsion of poor sitting posture.

The sitting furniture is designed to limit the scope of user activities through physical means such as wear, support and bondage. Users are then forced to maintain an upright sitting posture. Such designs are mostly seen in the relevant patents and products. These methods of forcing users to maintain the upright sitting posture can only obtain correct sitting posture in form, which cannot effectively prevent or correct poor sitting posture. In addition, due to the lack of proper guidance, users may develop wrong usage habits such as lying on the support or become dependent on it, leading to the aggravation of posture problems.

### 1.2.4 Design in combination with innovation theory.

Li, Z. C. et al.[9] designed a fun interactive system with a forced sitting posture corrector to improve user participation Lu, P. Y. et al. [10]used innovation methods to organize and analyze user needs, which led to the design of a sitting posture correction chair that better met user needs. However, due to users' lack of understanding of the relevant scientific theories of posture correction, the establishment of user needs is unreasonable and lacks guiding value for the design of posture correction products. Shin, J. et al. [11]proposed the "Relational Norm Intervention model" (RNI) for changing user behavior and designed a mobile application based on this model to correct users' sitting posture. This design research enhances users' participation and action by guiding their behavior, which helps greatly to enhance the effect of posture correction. Its disadvantage is that it only guides user behavior by enhancing motivation and lacks a comprehensive and systematic behavior guidance design.

Through the above analysis, it can be seen that most of the existing products carry out posture correction by prompting users to maintain the correct sitting posture. However, this single correction method cannot improve users' muscle state and lacks practical correction effect on the existing posture problems. Secondly, there is a lack of effective interaction between existing products and users. As a result, the product cannot guide user behavior. In the process of using the product, the correctness, autonomy and continuity of users' behavior are difficult to guarantee, resulting in poor posture correction. Furthermore, these products cannot help users develop good sitting habits and fundamentally solve the problem of users' poor sitting posture.

Based on this, this paper introduces dynamic posture correction into product design. Guided by the Fogg's Behavior Model theory, it is expected to guide user behavior through reasonable design and promote users to improve their muscle state to achieve better posture correction.

# 2 Materials and Methods

The Fogg's Behavior Model (FBM), also known as "Persuasive Design" or "Behavioral Design," was established by B. J. Fogg, a professor at Stanford University.[12] It unveils the mechanisms behind behavior generation and introduces strategies for guiding and designing behavior. The Fogg's Behavior Model theory enhances user-product interaction, finding extensive application in the field of interaction design. [13, 14]Building upon the FBM, Bai, Z.H.et al. [15]designed a game aimed at preventing cervical spondylosis, effectively guiding user behavior to enhance disease prevention and treatment outcomes. This study offers significant insights for the design research in related domains.

## 2.1 B=MAP Model

The B=MAP model constitutes the fundamental theory of the FBM. In this equation, B stands for Behavior, M represents Motivation, A denotes Ability, and P signifies Prompt. The equation as a whole signifies that behavior occurs when motivation, ability, and prompt converge. In other words, motivation, ability, and prompt are the three essential elements that lead to behavior. The relationship between behavior and these three elements is represented graphically, as shown in Figure 1. The curve on the coordinate system is known as the "Action Line," distinguishing whether a behavior occurs. When the intersection point of ability and motivation lies above the Action Line and is supplemented by a prompt, the behavior will occur; conversely, it will not occur.

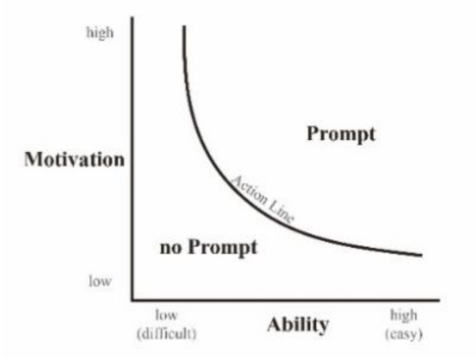



**Fig.1** Schematic diagram of B=MAP model

Furthermore, the greater the ability and motivation, the more likely a behavior is to occur, with the requirement that ability and motivation complement each other. For instance, when a users' ability is limited, enhancing their motivation becomes necessary to trigger the behavior, and vice versa. Additionally, a prompt is a prerequisite for behavior; only with a prompt will a behavior take place. Thus, effective prompts can be used to encourage users to perform a specific behavior, while removing prompts can deter certain behaviors.

The B=MAP model elucidates the conditions under which behavior occurs, making it a tool for analyzing the reasons behind the presence or absence of specific behaviors. The model also provides a foundation for designing behavior guidance. In practical design, strategies such as boosting user motivation, reducing task difficulty, and implementing appropriate prompts can be employed to encourage the desired behaviors envisioned by the designer.

### 2.2 Micro-habit strategy

The micro-habit strategy is a more operationally effective behavior design strategy based on the B=MAP model. Its core principle is to select a target behavior, break it down into a series of tiny actions, and put them into practice. As per the B=MAP model, these dissected tiny habits have lower demands on both user ability and motivation. Consequently, users can easily complete these tasks without relying heavily on willpower, thus boosting their motivation to act. Prof. Fogg proposes the ABC three-step process for cultivating Tiny Habits: first, selecting a suitable action prompt, known as an Anchor (A); then immediately performing the tiny habit upon receiving the prompt (Behavior, B); and finally, celebrating immediately after completing the action (Celebration, C), thereby reinforcing the tiny habit.

The micro-habit strategy offers a systematic approach to behavior design, enabling designers to deconstruct desired user tasks and create well-structured process guidance. This leads to a more seamless interaction between users and products, enhancing user experience and improving the effectiveness of product usage.

### 2.3 Fogg Principles

In addition to the aforementioned theories, Prof. Fogg also introduced two principles that behavior design should adhere to, known as the Fogg Principles. The first principle is "Help people do what they already want to do." Only when behavior aligns with user needs can long-term adherence be achieved. The second principle is "Help people feel successful." A positive user experience during the action process contributes to improved behavioral outcomes. In design practice, the Fogg Principles aid in enhancing the effectiveness and sustainability of user actions, fostering further progress.

This paper analyzed the core theories of the FBM. Guided by these principles, a posture-correcting desk-chair product has been designed to influence user behavior. This product aims to empower users with the motivation to engage in corrective activities by using the product, thereby achieving posture correction. Furthermore, it offers novel insights for the design of posture correction products.

## 3 Results and Discussion

Building upon the previously discussed theories of postural correction, effective posture-correcting products should encompass two primary functions: promoting users to maintain the correct posture during work and enhancing user muscle conditions. Therefore, a posture monitoring feedback system was designed to encourage users to maintain proper posture while working. Additionally, a dynamic posture correction system was developed to assist users in performing corrective activities during breaks, targeting weaker muscle groups. Meanwhile, the Fogg’s Behavior Model was employed in the analysis and design process. Innovative interaction design was integrated to effectively guide user behavior, enhancing the effectiveness of posture correction.

### 3.1 Design of Posture Monitoring Feedback System

The posture monitoring feedback system was designed to encourage users to maintain correct posture by continuously monitoring and providing real-time feedback on their sitting posture. The key lies in encouraging users to autonomously adjust their posture promptly upon receiving feedback. Drawing from the B=MAP model and analyzing the characteristics of the target behavior, user motivation can be enhanced, and the effectiveness of prompts can be increased to prompt users to make timely adjustments to their sitting posture.

As depicted in Figure 2, drawing inspiration from potted plants placed on a table, a virtual interactive system with a potted plant theme was designed to facilitate posture monitoring and feedback. Visual recognition-based posture monitoring technology was employed to enhance user-friendliness and improve the overall user experience. An actual product in the form of a potted plant with an embedded camera can be placed at a fixed position on the table to enable posture monitoring. Holographic projection technology was utilized to project an image of a plant above the "potted plant." This projected plant image can reflect users’ posture. Specifically, the color of the plant stem reflects users’ current posture: a green stem indicates good posture, while a red stem indicates poor posture that requires adjustment. The system records users’ posture over a certain period and uses the overall condition of the projected flower and leaves to reflect users’ recent posture. If the plant’s colors are vibrant, it signifies the recent good posture that should be maintained. Conversely, if the plant appears wilted or discolored, it suggests the recent poor posture, motivating the user to correct their posture for the plant’s vitality to be restored.

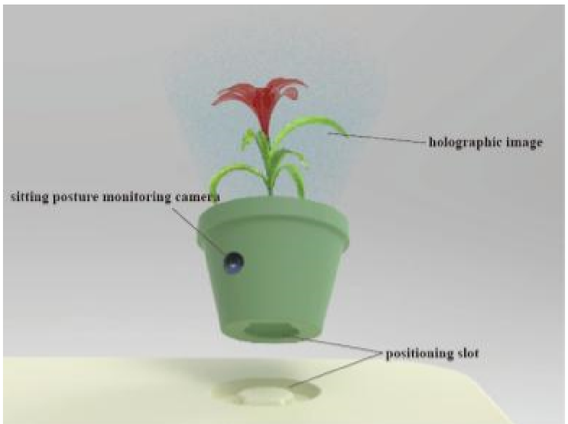



**Fig.2** Sitting posture monitoring feedback device

The posture monitoring feedback system establishes a connection between users' posture and the plant's growth status, improving the sense of user engagement. By offering rewards and consequences based on users' posture performance, the system enhances the motivation for users to promptly adjust their posture, sustain these adjustments over time, and cultivate good posture habits. The real-time changes in the plant stem's color are attention-grabbing, and the design employing contrasting red and green hues enables users to quickly comprehend their current posture, facilitating prompt adjustments, as illustrated in Figure 3. Through the reinforcement of user motivation and heightened prompt effects, the posture monitoring feedback system places the "adjusting posture" behavior above the Action Line. By fragmenting the task of maintaining correct posture into manageable steps—providing feedback reminders and guidance for posture correction when needed—the system aligns with the principles of the micro-habit strategy. This approach minimizes the psychological burden on users and encourages the gradual development of good posture habits.

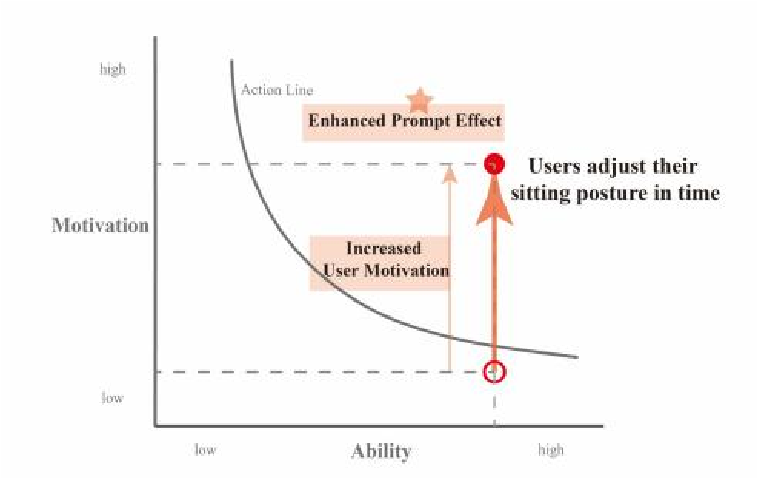



**Fig.3** Guidance of posture monitoring feedback system to user behavior

### 3.2 Design of Dynamic Posture Correction System

#### 3.2.1 System Design

According to Pomodoro Technique, users are invited to set their working and resting hours according to their situation, so as to encourage themselves to work and have a rest during which they can carry out a series of postural correction activities and correct their bad posture. The dynamic posture correction system mainly has three functions: rest reminder, assisted stretching and back massage, among which the rest reminder function encourages users to carry out casual activities to minimize the impact of sedentary activities on users' health and posture; the assisted stretching and back massage functions help users to strengthen the weak muscle groups. Combining the above three main functions, a reasonable process design is carried out, as shown in Figure 4.

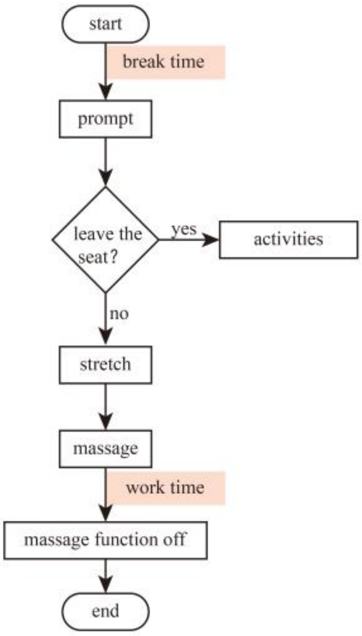
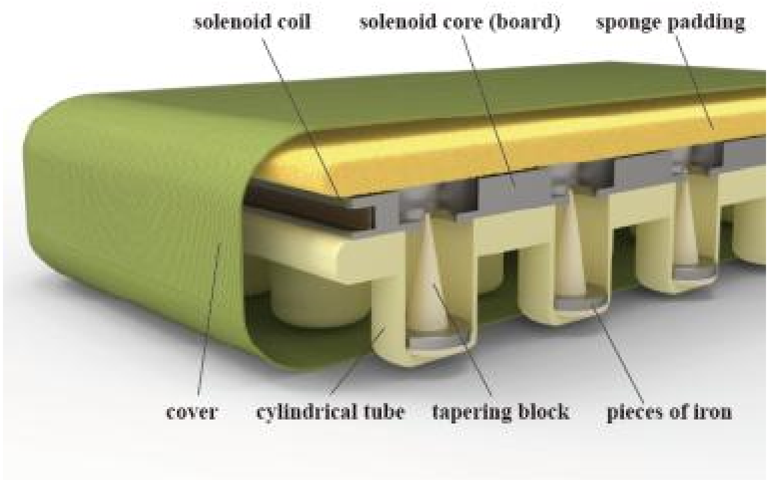



**Fig.4** Process design of dynamic posture correction system

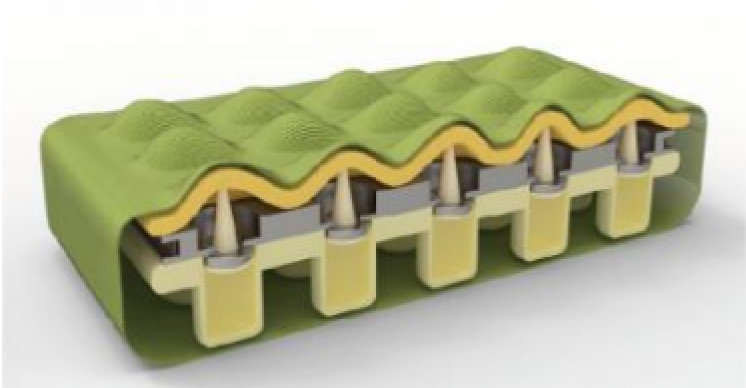
#### 3.2.2 Design and Implementation of the Rest Reminder Function

When users finish their work and start resting, the rest reminder function is turned on. According to the analysis based on the B=MAP model, it can motivate users to leave their seats for relaxation after receiving the reminder by enhancing users' motivation or the effect of the reminder. In turn, users will stay less in their seats by increasing the difficulty of the behavior or weakening the users' motivation.

Inspired by the Chinese idiom "to be on tenterhooks" (which means "to be on a mat of needles"), we designed the cushion of the seat. When the rest reminder function is turned on, the surface of the cushion produces uneven changes, causing slight pain to users' buttocks and prompting them to leave the seat. The electromagnetic principle is utilized to realize the above function, and the structure and principle of the device are shown in Figure 5. As shown in Fig.5(a), the cushion consists of a tapering block with an iron piece at the bottom, a cylindrical tube, an electromagnet, sponge padding and an outer cover of the cushion. The role of the cylindrical tube is to limit the position and displacement of the tapering block so that it can only make vertical up-and-down movements. As shown in Fig.5(b), when the rest reminder function is turned on, so does the circuit. After that, the electromagnet plate generates magnetic force, and the iron piece at the bottom of the tapering block is attracted by the magnetic force, which drives the tapering block to generate an upward displacement. When the tapering block lifts the padding, the surface of the cushion changes and prompts users to leave their seats. Once the rest reminder function is turned off, the circuit is disconnected, and the magnetic force of the electromagnet disappears. What's more, the tapering block falls back to the bottom of the cylindrical tube under the effect of gravity, and the cushion returns to its normal state.




(a)



(b)

**Fig.5** Schematic diagram of structural principle of rest reminder device

As shown in Figure 6, the rest reminder function is made possible because of the seat cushion design, which makes users feel less comfortable when sitting during rest time, so they are more reluctant to stay in their seats. When their motivation is weakened, and ultimately falls below the line of action, they will leave the seat, and carry out activities to relax themselves.

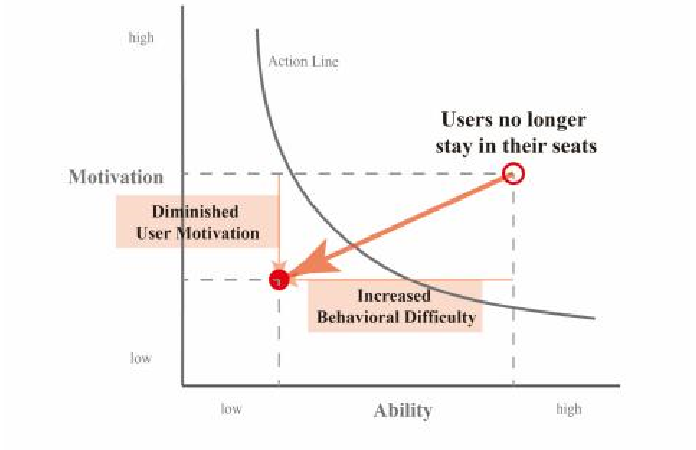



**Fig.6** Guidance of rest reminder function to user behavior

### 3.2.3 Design and Realization of Assisted Stretching and Back Massage Functions

According to the micro-habit strategy, the posture exercise, which is more intense and requires long-term persistence, is broken down into a stretching action after users receive a rest reminder to help them gradually develop the habit of stretching after sitting for a long time, and continuously improve the muscle condition. Because of this, the action of turning off the cushion rest reminder is combined with the back stretching action, so that users can fulfill their need to stay in the seat during the rest time while completing the postural exercise. In addition, a back massage is set up in the upper part of the seat backrest and is automatically turned on after users finish stretching to assist them in reducing muscle tension and increasing muscle elasticity.

According to the B=MAP model, users can be guided to do stretching by enhancing their motivation, reducing the difficulty of the behavior, and setting reminders. Among these, the cushion rest reminder already provides obvious cues. Users have a strong motivation to stretch as they can turn off the cushion reminder after that. Therefore, lowering the difficulty of the stretching behavior can further increase users' motivation to complete their stretching behavior.

Modeled after a hunchback-correcting stretching maneuver that can be done autonomously by users, an assisted stretching device is provided on the back of the seat, as shown in Figure 7. The stretching device contains a switch that controls the circuit of the rest reminder device and the back massage device to turn on and off. The rest reminder is turned on when the circuit of the rest reminder device is automatically turned on by the timer control. Users need to slide the slider from point B to point A to cut off the circuit of the rest reminder device and turn on the circuit of the massage device so that the cushion returns to normal and the massage function is turned on. As point A is far away from point B and the need to overcome the spring resistance, users need to use both of their hands to push the slider to the designated point (point A), which ensures that users' hands are uniformly exerted during the stretching process and lasts for a long period, which is basically in line with the requirements of the orthopedic stretching. In addition, the white part in the center of the slider has an undulating shape with the left side high and the right side low, which makes it easy for users to manipulate their hands. When the rest time is over, the locking mechanism at point A is released, and the slider returns to point B under the spring tension. The massage device circuit is disconnected, and the massage function is automatically turned off. Users can also reach out to the switch at the lower right side of the slider with one hand to close the massage function.

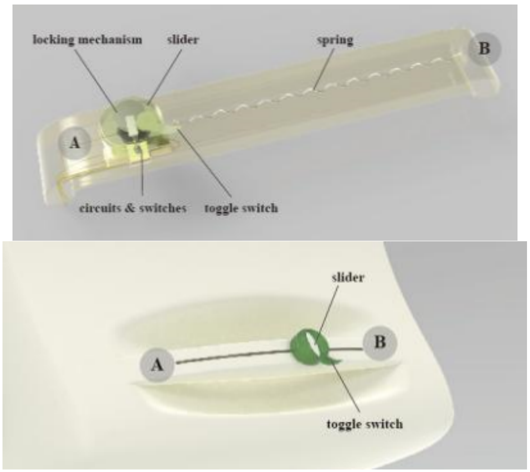



**Fig.7** Schematic diagram of structural principle of Assisted stretching device

The microhabitat design of the assisted stretching function is conducive to ensuring that users exercise and gradually improve their muscle condition. The design of the assisted stretching lever enables users to complete the orthopedic stretching more accurately without professional knowledge, reduces the learning cost, and makes the act of stretching less difficult, which is conducive to users to complete the stretching action more effectively. The back massage function that automatically turns on after stretching helps to improve users' muscle condition and consolidate the stretching effect.

### 3.3 The Overall Effect of the Product and Use Process

#### 3.3.1 Overall Effect

The overall design of the product is shown in Figure 8. The main dimensions such as desktop height, desktop inclination and seat height are adjustable, which meets the ergonomic requirements and helps users maintain a good sitting posture. The design of the desk drawer and side storage shelf provides users with large storage space, which helps to reduce the weight of users' backpacks and avoid bad posture.

**Fig.8** Display of sitting posture correction desk-chair product

### 3.3.2Use Process and Scene

The use process and scene are shown in Figure 9. Through the reasonable process design, the posture monitoring and feedback system and the dynamic posture correction system cooperate, so that users can get effective posture correction guidance when using the product. The application of the Fogg's Behavior Model makes the interaction between users and the product more effective, which better achieves the expected postural correction effect. The design of the micro-habit helps users to complete the sitting posture correction behavior easily and happily and insist on it for a long time, so as to develop a good sitting habit.

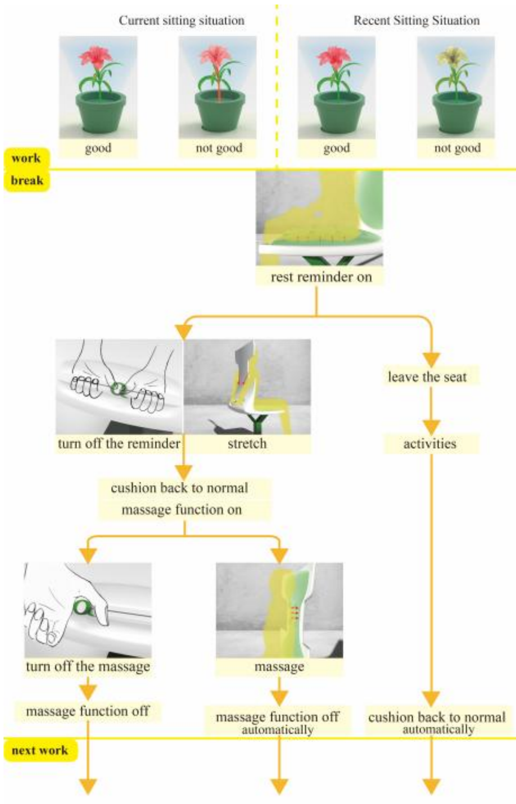



**Fig.9** Display of sitting posture correction desk-chair product use process and scene

## 4 Conclusions

This paper introduces the posture problems caused by poor sitting posture and its correction methods and organizes and analyzes the relevant research on sitting posture correction. Besides, this paper analyzes and practically applies the Fogg's Behavior Model theory, summarizes and analyzes users' requirements for sitting posture correction desk-chair products, and accordingly designs a sitting posture correction desk-chair product with the functions of sitting posture monitoring and feedback and assisted dynamic posture correction, and provides design guidance for user behavioral process. With the help of creative styling design and interaction design to convey the design concept, through the product to guide users' behavior, improve the posture correction effect, to meet users' posture correction and aesthetic needs. The overall design concepts and methods in the paper can provide a reference for the design research of related products.

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