Application and Research of Wearable Smart Devices to Assist Sleep

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Abstract. Sleep problems have become one of the main factors of contemporary sub-health, and are a very common problem for all ages. The China Sleep Study 2022 states that the global rate of sleep disorders is 27%, and in China, the incidence of insomnia among adults is over 38.2%, and 50% of students suffer from sleep deprivation. One-third of a person's life is spent in sleep when we cannot do anything, and too much time spent preparing for sleep will be wasted. With the development of artificial intelligence, it seems that we can improve sleep quality and efficiency through artificial intelligence technology. The article proposes a non-invasive way to conduct electrical waves to guide the sleep process and state, and to store, transmit and analyze data on the sleep process and the active state of brain cells. The wearable device senses and collects data, which is analyzed by an algorithm that detects and assesses the quality of a person's sleep and sleep environment, producing a sleep report. The sleep meter analyses the sleep and regulates the sleep through different wavelengths. The results show that artificial intelligence can be used to enhance sleep efficiency through Brain-Machine Interface, as well as some thoughts on the social issues that this approach may bring about, an unrestrained idea for making the most of sleep time.

Keywords: sleep efficiency; artificial intelligence; sleep data visualization; electromagnetic interference; electroencephalography; lucid dreaming.

1 Introduction

1.1 Research Background

Reports indicate that poor sleep quality is mainly reflected in insomnia, sleep deprivation, and sleep disorders. A typical adult sleeps for approximately 8±2 hours, with differences in age and other individual aspects. Sleep that is not suitable for an individual's body type may produce some health problems.

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Y. Chen et al. (eds.), *Proceedings of the 3rd International Conference on Culture, Design and Social Development (CDSD 2023)*, Advances in Social Science, Education and Humanities Research 834,
https://doi.org/10.2991/978-2-38476-222-4_70

1.2 Research Purpose

(1) To analyze the current state of the application of smart products in the market.

(2) To speculate the potential the scope challenges problems that can explored developed in the regarding of sleep efficiency in intelligence. Intelligence.

1.3 Research significance

Theoretical Significance: To explore the potential of artificial intelligence in the field of sleep health and establish a theoretical foundation for its advancement.

Significance: The aim is significance: to improved better design solutions for the development of intelligent products in this field and to explore potential for of product differentiation. To provide targeted references and advice for individuals seeking to enhance their sleep efficiency. To provide theoretical references and methodological guidance to people of different ages, occupations, and needs. To improve the quality of life.

1.4 Research Methods

Survey methods: questionnaires, interviews, literature survey.

2 Literature Review of Sleep Efficiency

2.1 Definition

The formula commonly used by the general public to calculate sleep efficiency: Is sleep Efficiency (SE) = Time in Sleep (ST) / Time in Bed (TIB). A result of >85% is the normal standard, with 90% sleep being considered excellent sleep efficiency. In practice, however, the inconsistency in the definition of sleep efficiency (SE) has led to misunderstandings among researchers and clinicians. The popular formula used to calculate sleep efficiency states that TIB includes non-sleep-related activities (e.g. reading, texting, talking to a partner, watching TV) before sleep onset and after eventual awakening. However, the standard way of calculating SE is as total sleep time (TST) compared to the time spent in initial sleep onset and sleep interruption. Activities in bed that are not related to sleep are not counted in TST. Also, periods of nocturnal wakefulness, sleep discontinuity, etc., should be counted in TST. The use of TIB as a denominator also raises methodological issues when SE is used in sleep intervention studies. It is recommended that the structure of the SE be captured more accurately through explanatory notes and the use of consistent operational definitions. For realistic and valid results in research and practice, it is recommended that another denominator be used, namely the duration of sleep episodes (DSE), where DSE = sleep onset latency (SOL) + ST + time awake after initial sleep onset but before final awakening (WASO) + time attempting to fall asleep after final awakening (Tassa method). The recommended SE formula is SE = TST / DSE (x 100). (DSE can be easily calculated using one of the standard sleep diaries as well as the extended consensus sleep diary.) [1]

2.2 What kind of sleep is considered inefficient?

By definition, sleep inefficiency refers to the ratio of the time it takes for us to sleep to the time we fall asleep completely to the total time spent asleep. I.e., inefficient sleep should be slow, with a long sleep latency and a long interval between awakenings and re-sleeping. The individual sleeps for longer than the individual's physiological needs.

2.3 The Effects of poor sleep efficiency

The main effects of poor sleep efficiency have been reported by various researchers as lack of sleep and poor sleep quality. We are deprived of our normal sleep time, which leads to psychological (depression, anxiety, poor concentration, and reduced ability to think during the day, etc.) and physiological (disruption of the hormonal balance in the body, abnormal immunity, brain damage, etc.) problems. Both short sleep duration (≤5h or ≤6h) and long sleep duration (≥9h) are associated with an increased risk of hypertension, and studies suggest a possible U-shaped curve between sleep duration and hypertension. Hongmin Wu et al. studied the correlation between sleep duration and hypertension, diabetes mellitus, and coronary heart disease in 14,700 permanent residents aged 18-75 years and found that the prevalence of hypertension, diabetes mellitus, and coronary heart disease was higher in those who slept <6h/d and >8h/d compared to those who slept 6-8h/d. Insufficient sleep during infancy and preschool is an independent risk factor for overweight/obesity in school-age children. The distribution of sleep duration among children aged 0-6 years varies according to age and body mass index, and sleep duration in children aged ≥2 years is associated with serum 25(OH)D levels, so adequate and appropriate sleep and to provide regular vitamin D supplementation are essential for optimal growth and development.[2][3][4]

2.4 Judging sleep efficiency

Before we can improve sleep efficiency, we need to clarify what it means to have good sleep quality. Some research scholars believe that the definition of sleep quality can be defined in three aspects: (1) the process of the sleep is judged through subjective; (A study of the difference in the impact of sleep quality on health-related quality of life at different ages- based on data from 1029 cases in Beijing); (2) the process of sleep is measured through objective indicators; (3) the effect of sleep is measured through physiological and psychological indicators. Sleep quality is a subjective assessment of an individual's objective indicators of their sleep process and the effects of sleep. Some researchers believe that a comprehensive assessment of sleep quality should include a combination of objectively measured physiological indicators and the individual's subjective evaluation of sleep, to understand and create the optimal sleep for each individual in all aspects.

Methods of sleep measurement:

The main methods of assessing sleep quality include subjective and objective assessment methods.

Subjective assessment methods include the Self-Rating Scale of Sleep and the Pittsburgh Sleep Quality Index (PSQI), among others. Common methods of objective assessment include out-of-center sleep testing, polysomnography (PSG), and actigraphy.

The Pittsburgh Sleep Quality Index (PSQI) is currently the most commonly used scale in China, as the average person cannot immediately and accurately assess their own sleep quality due to environmental constraints. People with a need to improve their sleep quality can choose to keep a sleep diary and determine the appropriate amount of sleep on their own.[5]

2.5 Differences in the sleep needs of the general population

Do we all have the same need for sleep? The World Health Organisation has introduced strict guidelines for the recommended amount of sleep per day for children of different ages ranging from 14-17h at birth to 10-13h at 3-4 years of age, decreasing with age .[6][7]

Some surveys have found that the daily sleep time of residents decreases in sequence with age. It is generally believed that older people require less sleep, usually 5-7h, due to a slower metabolism and less physical work, but some studies suggest that the sleep time of the elderly cannot be reduced. However, further research is needed in our country on the relevant aspects of information.

In addition to variations in the amount of sleep required in terms of age and other aspects, our genes sometimes tell us how much sleep we need. Geneticists have analyzed the variant gene - hDEC2 - from short sleepers. They only need to sleep for about four hours to ensure that they wake up energized. Some people require up to 10 hours of sleep to ensure they get enough rest. Long sleepers may also be due to genetic influences.[8][9]

The Role and Impact of artificial intelligence products in improving sleep efficiency.

2.6 Preface

I. Background of the study:

With the rapid development of modern society, various problems regarding sleep have emerged. The increasing number of sub-healthy people and the high pressure of time have prompted the public to seek quick solutions to sleep issues and to shorten sleep time as much as possible. The growing demand for a wide variety of treatments has created a thriving sleep economy. Traditional treatments range from a) Chinese physiotherapies such as acupuncture and moxibustion or acupressure, herbal baths, foot baths, cupping, gua sha, etc.; b) Chinese herbal medicine, which is commonly used to treat the condition, such as most commonly used treatment, Jusha An Shen Wan; c) Western medicine, which is clinically used to stimulate the production of melatonin with drugs containing Valium. These range from the "golden four-hour sleep" method, which has emerged around the world. To melatonin, aromatherapy, and other related products. Insomnia sufferers are jumping on the bandwagon. The public was concerned about the potential side effects of Western medicine, the slow effect of Chinese massage, and the lack of scientific validity of sleep techniques. People are starting to think

about finding other ways to improve sleep. As technology continues to evolve, from mobile phone intelligence to electronic pulses to brain-computer interfaces, more and more smart products are bringing new ideas that are more intuitive and more effective.

3 Research Methods and Result Analysis

(i) Survey participants.

(1) Data sources: ii Media Consulting - Research Report on the Development and Consumer Demand of China's Sleep Economy Industry, 2023-2024; Tian-eye Survey Data – Sleep.

Economy-related Enterprises; China Research Institute's "China Sleep Economy Industry Market Deep Research and Investment Strategic Planning Research Report, 2022-2027.

(2) Sample size: 1; N=2622, research time: April 2023.

(3) Study population: those who need sleep and are open to seek outside help and do not reject smart products. A survey of Chinese nationals with a willingness to consume sleep products and services.

Research content: background survey, sleep awareness, willingness to consume sleep products and services, product preference and price acceptance, and user needs.

Data entry.

Statistical analysis by the author is based on the iiMedia Research report. As shown in Fig.1-2.

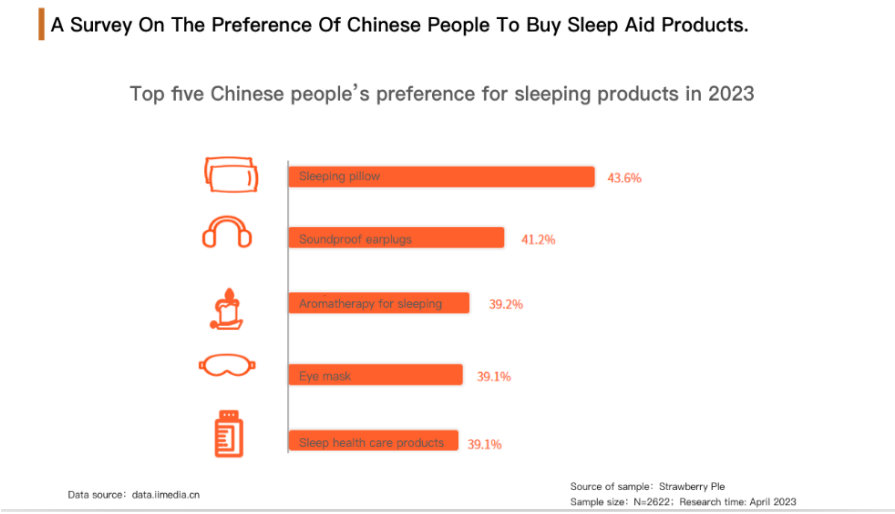

Fig. 1. Top Five Chinese People's Preference for Sleeping Products In 2023 (source: iimedia consulting)

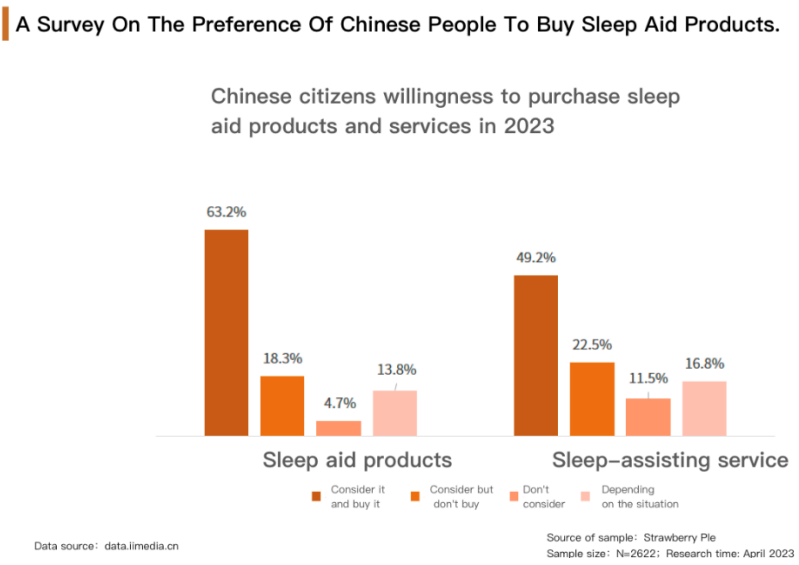

Fig. 2. Survey on The Preference of Chinese People to Buy Sleep Aid Products (source: iimedia consulting)

(ii) Exploration of artificial intelligence products in the direction of enhancing sleep efficiency.

Current market situation.

Daily Domain: Statistics show the percentage of insomnia and the proportion of people who require sleep products. Nearly half of the population would choose a pillow with a sleep aid function. There are also numerous smart hardware products and home textile products with sleep status monitoring functions in the domestic and international markets. Among the smart hardware products, Samsung Electronics, Nokia, and Apple have all entered the smart bracelet market through acquisitions and other means, and Huawei and Xiaomi bracelets are also popular products in the market now. These products primarily focus on recording the user's sleep patterns and cannot give effective advice for improvement. In the future, the ability to offer sleep solutions will become an important opportunity for sleep product companies to challenge the norms.

Now the market is divided into two main categories of products accessible to the general public: sleep APP, smart products (smart pillows, eye masks, mattresses, pulse sleep instruments, bracelets, etc.), smart pillows - AI self-learning algorithm pressure sensor matrix, mainly to solve the issue of sleep snoring. Sleep APP-monitoring sleep, provides soothing and relaxation, music for sleep, biogenic noise reduction, physiological monitoring technology to feel the real-time heartbeat (small sleep), sleep instrument (with Bluetooth playback to guide sleep, a-wave), electronic pulses, sleep acupuncture point stimulation.

3.1 Sleep revolution brought about by artificial intelligence

(1) Quantify the user's sleep to better inform the user of their sleep patterns. Example: The Snail Sleep App works by utilizing the phone's accelerometer sensor to measure the user's sleep status by detecting the user's activity while sleeping. (As shown in Fig.3), Snail Sleep utilizes accelerometer sensors and microphones to identify body movements and sounds in two dimensions while using a body movement algorithm to monitor the sleep cycle and state. The app utilizes the phone's microphone, gravity sensor, and gyroscope for detection. This includes the amount of movement we make when we turn over, etc. It has some reference value. The sleep recognition algorithm integrated into Snail Sleep has been tested and compared in a large number of professional sleep labs and compared with professional EEG and ECG sleep monitoring devices for sleep data. The sleep algorithm is tailored and optimized for various models of iPhone 4, 4S, 5, 5S, 6, and 6Plus devices to ensure the accuracy of the sleep tracking.

Fig. 3. sleep data (source: snail sleep)

(2) Data is collected by sensors and analyzed by algorithms to monitor and assess the quality of a person's sleep and sleep environment, providing sleep reports and recommendations to help individuals improve their sleep quality and overall health. Some sleep pillows can be hypnotic, the human brain is awake when the brain is mainly beta waves (14-30HZ), and rest will produce a lower frequency wave amplitude greater alpha waves (8-13HZ), smart pillows utilize technology to make the brain value difference in frequency of 10HZ sound waves thus allowing the user to relax whole body and mind, equivalent to a deep hypnosis player software, some smart pillows need to wear headphones through the user to achieve sound waves Some smart pillows require the user to wear headphones to transmit the transmission of sound waves, but some smart pillows can be Achieved through bone conduction technology to obtain sound without wearing headphones.

(3) Other types: The first type is a sleep instrument that sends out low-frequency electromagnetic waves to stimulate the brain so that the brain's excitement level grad-

ually decreases, allowing the person to fall asleep quickly. The second type sends stimulation signals to the brain so that the brain makes adjustments according to the strength of the signal stimulation, causing the brain to become less and less excited and eventually fall asleep; the third type is a digital frequency synthesis of bionic waves, where the sleep instrument sends out bionic waves to cause regular activity in the brain and enhance the quality of sleep.

Areas of expertise: The most direct application of AI in sleep medicine is the analysis of multiple physiological signals obtained during polysomnography (PSG) monitoring. This application holds the potential to deepen our understanding of normal sleep and sleep disorders, improve disease staging, increase the efficiency of sleep laboratory operations, and enhance patient care. Data analysis performed by AI must be combined with a careful assessment of patient signs and symptoms, demographics, and comorbidities, as well as reassessment during the treatment of chronic conditions. As with all diagnostic tools, the extent of AI's impact will rely on the clinician's proficiency in utilizing the tool. The translation of AI from a research-based concept to an effective care tool will require extensive research and experimental support. The American Sleep Medicine Foundation has identified AI as one of the specific research areas for its 2020 Strategic Research Award program. Through continuous collaboration with sleep disorder care teams, researchers, and product developers, AI will enhance our understanding of sleep disorders and their impact on health, thereby improving the care provided to all patients with sleep requirements. Using AI to stage-record sleep and score respiratory and motor events can reduce the time sleep technicians spend on polysomnography (PSG) scoring. This, in turn, enables them to provide more assistance to patients who can generate validated data from wearable and mobile devices. In addition, Japan has started utilizing skin to measure the human biological clock in order to alleviate insomnia. A research team, led by Minister Kazuo Mishima at the National Centre for Psycho-Neurological Research, has developed an effective method for determining the human biological clock. The method uses only a few square millimeters of skin to accurately measure an individual's biological clock by assessing the activity of genes associated with the body's circadian rhythm. In alignment with the patterns and rhythms of the body's circadian rhythm, the new treatment can effectively alleviate or eliminate the symptoms of insomnia in individuals suffering from this condition.[10]

3.2 The role of brain waves

Before we can improve sleep efficiency, we need to understand the human biological clock and how sleep works, and how it works, based on the overall human sleep situation. There are two main types of sleep: non-REM sleep and REM sleep, with one cycle lasting 90-100 minutes, and a complete sleep consists of approximately 5 sleep cycles. The first 90 minutes of the initial sleep cycle are crucial for a restful night's sleep and are referred to as the "golden 90 minutes"(As shown in Fig 4).

Table 1. N- REM Alternates with REM Sleep (Data collection and statistics by authors) [13]

Classic EGG rhythm	Frequency spectrum	Frequency	Be distributed	State	Behaviour	Physiologically related	Training effect
δ		1~3Hz	Wide, diffuse, bilateral, universal	Deep, dreamless sleep, tconscious, unconscious	Drowsy and inattentive	Stay still and wake up at a low level.	Drowsiness, relaxation, extreme relaxation
θ		4~7Hz	Regional, appearing in multiple lobe, unilateral or diffuse	Intuition, creativity, memories, fantasy, imagery, fantasy	Creativity and distraction may be distracted.	Physical and mental integration	Enhance, drift, distract, suppress, focus, focus
α		8~12Hz	Regional, participate in the whole brain lobe	Relax, but not tired.	Meditate	Relax	Relax
β-LF		12~15Hz(SMR)	Lateral leaves	Easy, focused and integrated	Easy and focused	Suppress movement	Concentrate and improve your attention in a relaxed state
β		15~20Hz	Local, covering different areas	Think, perceive your self-state and your surroundings	Mental activity	Alert, take the initiative	Improve mental intelligence, attention and awakening
β-HF		20~35Hz	Local, very concen-trated	Alert and excited	Mental ac-tivity.	Activation of mental and physical functions	Alert and excited
γ		>40Hz	Very local	Thinking, comprehen-sive thinking	Advanced information processing	Integrate new information Training effect	Improve thinking clarity, efficiency and language ability

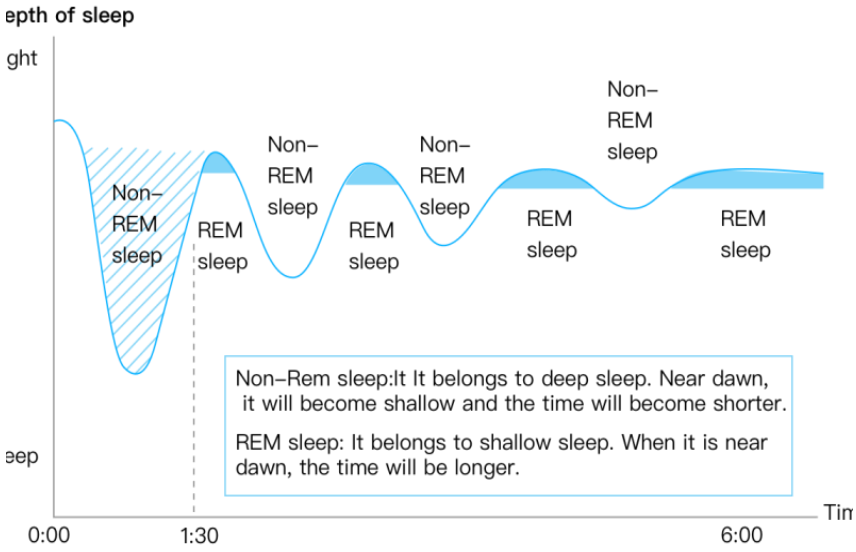

Fig. 4. Electroencephalogram, EEG (Source: The Stanford method of efficient sleep)

*(It is important to note that the EEG signal rhythm is not solely determined by the frequency range, but is also related to its temporal and spatial distribution characteristics, physiological state, and other factors.) For example, the frequency of an alpha rhythm may sometimes be lower than 8 Hz, but it can still be considered an alpha rhythm according to the standard definition.

The human brain has five main waves.As shown in Table 1. In the waking state, there are almost no delta waves in normal adults, but delta waves can appear after sleep, and delta waves will gradually increase as sleep progresses from light to deep if the frequency of brain waves below 8Hz is called slow waves. Based on the pattern of human brain waves, can we use intelligent algorithms to guide the brain-computer interface as a medium to make the "golden 90 minutes" come faster?

III. Speculation on the scope and problems that can be developed by AI in the future in the direction of sleep efficiency[14][15]

3.3 Sleep Boosting

As shown in Fig.5, According to the previous article and the collected literature, the amount of sleep required varies according to age, gender, and genetics. Therefore, the author believes that by detecting (calculating) the optimal sleep time that belongs to you, the sleep efficiency can be compressed for some time: the sleep latency is about 30 minutes, which can be compressed as much as possible, to get into bed and not affect the nightly sleep cycle, and not affect the health of the body mainly. When we understand the state of the brain and body during sleep. We can find that during quality sleep, a person's body temperature is in a reduced state. Therefore, it can be said that a decrease in body temperature is essential for sleep. The body temperature of a person in

the waking state is higher than the body temperature during sleep. During sleep, the body temperature drops, and the internal organs, muscles, and brain go into a state of rest. In contrast, the body temperature rises when awake to sustain the body's activity. However, the change in body temperature mentioned here refers to a change in the body's internal body temperature (i.e. internal temperature). If this change is facilitated in some way, the process of falling asleep becomes easier. This has also been proven in human experiments. When you fall asleep, your internal temperature drops, your surface temperature rises, and the difference between the two decreases. This is the first switch to achieve the golden 90 minutes of sleep. From a temperature point of view, it is possible to consider mattresses and other skin-accessible bedding, room temperature regulation, etc. to assist the user in getting to sleep as quickly as possible.

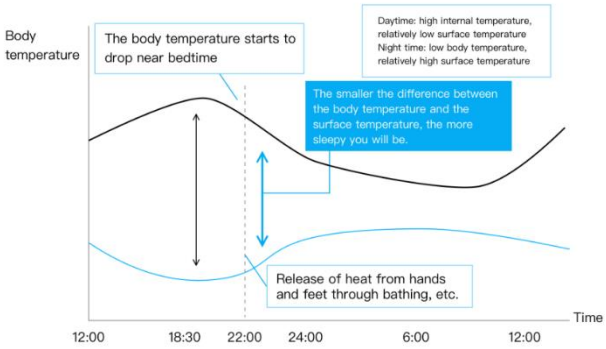

Fig. 5. The Difference Between Body Temperature (Source: The Stanford method of efficient sleep)

In addition to this, when the brain is excited, it can be difficult to bring down the body temperature. A recent explanation for "primary insomnia" (which has no specific physical or psychological cause) is that it occurs due to a state of excessive wakefulness when body temperature continues to drop erratically and body temperature rises. Turning off the "brain switch" can help prevent disruptions in the early stages of sleep. The brain waves slow down and you gradually enter slow-wave sleep. You can try to disturb the active brain by guiding the EEG into the delta band with soothing waves. This accelerates sleep.

Other ways: The brain waves are adjusted in stages to the important sleep time that needs to be ensured for different age groups, for example, for children in a growth phase, brain wave interventions are carried out to ensure sufficient sleep and allow growth and development to be adjusted to an optimal state in line with the individual. Maximizing the Efficiency of Sleep. The modulation of brain states by means of different electrical waves. Adjustment of the sleep rhythm by means of a brain-computer interface to the electrical brain waves. δ waves 0.4-4 Hz Deeply asleep, unconscious

state when δ waves are the dominant brain wave. There is a direct correlation between the quality of one's sleep and delta waves; delta sleep is a dreamless and deep sleep state that typically occurs four to five times a night in a normal sleep cycle, and the first emergent cycle that occurs in the early stages of sleep is the dreamless delta wave (Non-REM) state, so if you can train yourself to summon the sensations of mind and body that resemble the delta wave limbic state when you are tossing and turning (with the training of course), you can quickly get rid of insomnia and Fall into a deep sleep, which is the type of short but restful sleep you are looking for. In addition, according to scientific research, beta waves are also key to developing the human intuitive system. The brain waves can be guided either by instruments that play music to the right beat or by stimulating the brain waves with acupuncture. Exposing the individual to the scent of jasmine is effective in eliciting alpha waves and reducing mental activity. In addition to this, visual relaxation can also be achieved through instruments. Calming color combinations are used to stimulate the corresponding electrical waves. Generally speaking, light blue, light yellow, and orange are beneficial for maintaining mental concentration and emotional stability, while white, black, and brown are not good for improving academic performance. Medical practitioners have found that light blue in a patient's room can help stabilize a patient with a high fever, purple calms a pregnant woman, and ochre helps to raise blood pressure in patients with low blood pressure. Workers who spend their days working with black coal are more likely to suffer from blurred vision and a hazy mentality; if the room in bright colors, the mental state can be improved. Therefore, we can consider a combination of visual, gustatory, auditory, and tactile stimuli to adjust the sleep-related electrical waves. Further research is needed to determine whether this approach is effective in improving sleep efficiency and making the brain more responsive.

Using dreams: Experiments have shown that what cannot be learned effectively during sleep, but what is learned before bedtime, may be better recalled the next morning. The "thinking" during dreams is different from that during waking hours and lacks logical inferences, but on the other hand, such non-logical associations may be creative in some way. Some scientists in the history of science have attributed their creative discoveries to the dreams they have had. The German chemist Kekulé, for example, recounted how he was inspired by a dream to come up with the cyclic structure of benzene. He was thinking hard about the structure of benzene when, one day, he fell asleep during his exertions and saw a snake biting his tail. When subjects are awakened from sleep in a sleep laboratory, many report that they are thinking about some of the thoughts that arose during the previous day. Similar findings have been made in experiments with rabbits. The rabbit was startled during the day, and its brain waves were recorded. When the rabbit fell asleep at night, its brain waves showed similar characteristics to those of daytime fright, and the rabbit's eyes were moving rapidly at this time, indicating that it was in the middle of a sleep period. This has led researchers to suggest that a function of sleep is to rearrange and consolidate new and important experiences from the day and enter them into the memory bank while also erasing some of the original, less important memories. There have also been experiments that have passed on the interaction between dreams and reality, although this direction needs to be developed further. The "lucid dreaming" training mentioned in "The Quality Sleep

Method" may provide inspiration and ideas for solving some of our real-life problems through dreams.[11]

3.4 Sleep data

In addition to individuals with psychological sleep disorders, there is also a subset of patients with physiological sleep disorders. Long-term psychological sleep disorders can also turn into physical problems, and it is then that the patient should seek medical assistance. In addition to the daily sleep data collection, the information can be recorded and analyzed over a long period and then passed on to a doctor, who can assess whether there are other serious psychophysiological issues. It provides a more objective and accurate assessment of sleep problems and precise treatment.[12][13]

4 Conclusion

Question.

As for the contribution made by artificial intelligence in the field of sleep, there are certain problems with whether.

1. The accuracy of sleep data, which may be biased by interruptions in the use of instruments if they are not monitored by humans.

2. the existence of human misgivings about AI-electromagnetic aspects, fearing the existence of problems such as radiation, the existence of side effects, and whether it will affect health;

3. The existence of dependency;

4. the privacy and security of the sleep data collected are difficult to guarantee.

Therefore, for the brain-computer interface, the use of brainwave-assisted therapy needs to be strictly controlled, tested, and used with caution, otherwise, it may bring a range of problems, such as mind control, insanity, delinquency, etc.

The treatment of insomnia patients and the treatment of psychiatric patients through smart devices has been very helpful. The utilization of artificial intelligence algorithms to analyze sleep data, generate treatment plans, and intervene by sending electric waves through smart devices is effective and has a good effect in improving sleep efficiency.

a) As different people have varying sleep needs due to their physiological qualities, insomnia patients need to be observed over time, tracked and recorded, and the content recorded by the brain-computer interface stored.

b) Optimal ratios are made according to the patient's needs for sleep efficiency, light sleep, deep sleep, and total sleep duration, helping the user to make full use of sleep time and achieve complete relaxation of both the body and mind.

c) It is possible to improve the subjective descriptions of patients with psychiatric disorders during their communication with the doctor based on the dream recording and restore them to the tablet through dream recording technology, thus providing better treatment for psychiatric patients.

However, whether we can interfere with electrical waves in this case using brain-machine apparatus, adjusting the brain wavelength in different situations, and whether

this will bring about serious side effects needs to be followed up and studied. In the future, it may be possible to enhance sleep efficiency more effectively by determining the optimal wavelength through brain-computer interfaces, making sleep preparation times shorter, allowing such sound waves to adjust our sleep structure, and allowing dream customization. Or even restore dreams so that we can have more time and unforgettable experiences.

References

1. Reed, David L.& Sacco, William P. (2016): Measuring Sleep Efficiency: What Should the Denominator Be? Journal of Clinical Sleep Medicine, 263–266.
2. Xing Ming& Zhihong Wang (2018): Progress of domestic and international research on the relationship between hormone secretion and less sleep leading to obesity or overweight. Journal of Nursing: 45-48.
3. Z Yang & Youfang Hu & Jing Li& Lin Zhang& Guangyu Liang& Qin R& Qin Z. Y. (2022): Distribution of sleep duration in children aged 0-6 years. Jiangsu Medicine:1256-1259.
4. Alvarez C&Paredes-Arévalos L&Obando I, et al. (2020): Consequences of low sleep duration in anthropometric and body composition parameters of Chilean preschoolers.Children (Basel):8.
5. Yanfeng Suo (2017): A study on the differences in the effects of sleep quality on health-related quality of life at different ages-based on data from 1029 cases in Beijing.
6. Detao Wang& Hewu Lv&Hata Cun Li (2023): Guidelines on physical activity, sedentary behavior and sleep in children under 5 years of age". School Health in China:645-648.
7. Guangsheng Ma & Zhaohui Cui& Xiaoqi Hu& Yanping Li &Ailing Liu& Dechun Luan& Lingzhi Kong& Xiaoguang Yang (2006): Analysis of sleep duration in Chinese residents. Chronic Disease Prevention and Control in China:68-71.
8. He, Y.&Jones, C. R.&Fujiki, N.&Xu, Y.&Guo, B.& Holder, J. L.& Rossner, M. J.& Nishino, S.&Fu, Y.-H. (2009): The Transcriptional Repressor DEC2 Regulates Sleep Length in Mammals. Science:866–870.
9. Dong Qing&Nicholas W. Gentry&Thomas McMahon& Li Gan, Louis Ptacek& Ying-Hui Fu.et al (2022): Familial natural short sleep mutations reduce Alzheimer pathology in mice: 1-15.
10. Ministry of Science and Technology official website, Japan's use of skin to measure human biological clock can be used to relieve insomnia symptoms, 2013 (9-2).
11. Qidong Li& Longchang Min(1998):Studies on sleep and dreams .Journal of East China University of Science and Technology, 65-70.
12. Sibel Tekin & Jeffrey L Cummings (2002): Frontal-subcortical neuronal circuits and clinical neuropsychiatry: Journal of psychosomatic research :647-654.
13. Qunxia Gao (2015): Study of EEG-based sleep staging and sleep assessment methods:13-15.
14. Seigi Nishino (2018). The Stanford method of efficient sleep: Cultural Development Press: 120-143.
15. Rafael Pelayo (2022).How to Sleep: The New Science-Based Solutions for Sleeping Through the Night: Citic Press Corporation: 261-279.

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