

Deep Sleep: Creating a Quality Sleep Product Experience for Adult

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ABSTRACT

The aim of this study is to investigate how to improve the sleep quality of adults by designing quality sleep products to meet the increasing health needs in modern society. With the accelerated pace of life and increased work pressure, sleep problems are prevalent among adults, seriously affecting the physical and mental health and quality of life of individuals. By analysing the current status of sleep problems globally and domestically, this paper explores the multiple factors affecting sleep, including physiology and psychology. The study points out that quality sleep product design should fully consider the needs of users and focus on personalisation and technological innovation. Ergonomic design and intelligent functions are explored through a combination of qualitative analysis using case studies and interviews, aiming to provide customised sleep solutions for adults. The findings suggest that scientific and rational sleep product design can significantly improve the quality of sleep for adults, which in turn enhances overall quality of life and social well-being.

KEYWORDS

Sleep light design; multifunctional design; health design

1 Introduction

This study aims to design a sleep aid that is both functionally versatile and emotionally resonant by exploring the sleep problems of adults today. Research has shown that an increasing number of adults suffer from poor sleep patterns, severely affecting their health and well-being (Makimura, 2011). However, the proliferation of new electronic devices has exacerbated the sleep disorders of today's youth. Not only do they bring convenience to people's lives (Meixian, 2015), but they also bring online learning. At the same time, it also brings a lot of adverse effects. For example, staying up late to play games and watch dramas has been the norm for most people. This has also led to sleep disturbances and disruption of bodily functions (World Sleep Day, 2022). However, most solutions to sleep problems are still limited to oral medications (Danielle, 2023). Although drugs can treat symptoms in medicine, side effects are common (Allegaert and Choonara, 2016). Therefore, designing a light therapy product to help young people sleep in a way that is as less harmful to the body as possible is what designers should be challenged to do in today's fast-paced society.

2 Project Overview

The focus of this study is on what kind of product designed to combine with lighting would be the ultimate popular sleep aid for the target population. However, there are many styles of products, and it is critical to find out what matches the lighting.

2.1 Sleep states due to electronic effects in contemporary adults

Sleep is crucial for physical and mental health as it accounts for one-third of their lives (Medina, 2023). Numerous data show that sleep deprivation can lead to narcolepsy, disruption of circadian rhythms, a feeling of lethargy, and impaired judgment (Neha, 2021); however, sleep deprivation is also accompanied by low mood and can lead to depression and anxiety. Severe ones are more likely to suffer from heart disease (Jung, 2011). Studies have shown that people can only physically and mentally benefit from enough sleep. This is because sleep regulates one's body metabolism and heals one's body cells (Potter, 2016). This shows that sleep is as essential to people as the nerve center is to the brain (Anne, 2024).

2.2 The effect of light colour on adults

Today, the increased use of electronic devices is significantly impacting the physical and mental health of adults (World Sleep Day, 2022). Melissa's (2022) study states that the blue light emitted by electronic devices can disrupt people's biological clocks. It can also inhibit the production of sleep hormones at night, leading to decreased sleep quality (Zerbini, 2020).

Regarding the effect of light colour on people, studies have shown that yellow light is the most beneficial light colour for the eyes and sleep. However, the cool white is highly comfortable (Nomoto, 2014). Although yellow light comes in second, it is still the most heart-healthy colour (see Figure 3).

From the perspective of design work, the impact of lighting on people is well-documented in healthcare and well-being environments. As early as 1933, Alvar Aalto, the modernist master of humane design, designed the post-war Sanatorium at Paimio Hospital in Finland, which is lit in warm colours, especially at the head of the beds where the light does not shine directly on the eyes, but hits the ceiling so that the light is reflected downwards. This gave the patients the ultimate sense of security (Alvar, 1933). In conclusion, the effects of lighting on people are well documented.

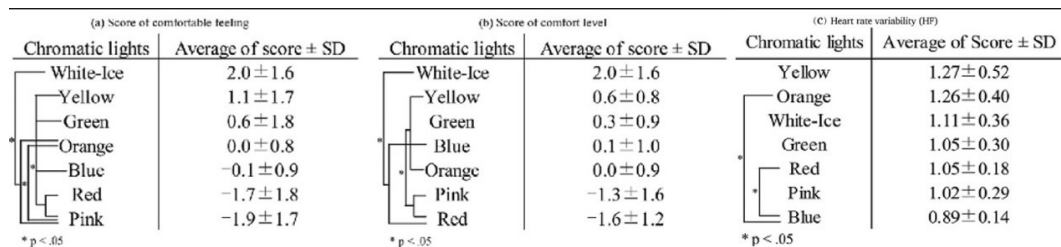


Figure 1 The impact of light colour on people's comfort and heart rate, based on Nomoto, et al., 2014, p.44-45.

2.3 Precautions for Light Therapy

According to research, natural light can have unpredictable elements, but light therapy devices can artificially control the treatment, ensuring the sustainability of the light (Girasol, 2022). On the contrary, artificial light therapy, although convenient, requires some advance attention to design matters and may lead to side effects such as blurred vision, headaches, and nausea if the design principles of the light are not followed (Roberts, 2023). Therefore, it is important to consider the precautions involved in using light therapy equipment and its design.

Firstly, the light should not be close to the eyes to avoid discomfort. Secondly, the light therapy time needs to be adjusted to 30 minutes or more to be effective, and thirdly, the light should not be looked at with the eyes open (Brandon, 2023). Therefore, these design prerequisites will provide important information for this study to explore the three design concepts of light therapy products.

3 Aim and objectives

This study aims to design a sleep aid for the sleep-deprived that has a diverse range of features while also having an appearance that resonates emotionally with the target population.

1. A literature study was conducted to understand the current sleep situation of the target population and the evidence to support the conceptual design.
2. Through case studies, extract the characteristics of the form and function of the target products that have been popular in recent years.
3. The characteristics of the target products are identified through semi-structured interviews. Analyse the subjects' preferences for the appearance and function types of the three products.
4. Three different design concepts were devised by combining the data from the first two steps of the study.
5. The three concepts were evaluated again through focus groups.
6. The final concept will be refined and enhanced after it is selected based on the analysis of the iterative exploration results.

4 Methods

For the sleep aid products to align with the needs of today's youth, this study must sign its ethical and honesty contract before it is carried out so that the participants are fully aware of the steps and precautions to be taken in the interviews. Firstly, a case study was conducted to identify three concepts of products that meet today's needs and were designed in conjunction with light therapy lamps. Secondly, semi-structured interviews were used to target each individual in a multidimensional way to ensure diversity of data and to analyse and summarise the design results concretely. Finally, a specialised focus group deepened the iterative design exploration to make the products more appealing to the target audience.

4.1 Case Study

A case study is a qualitative analysis that provides detailed knowledge already available in real life and is generally used in the early stages of research (Laelengliana, 2020). This study uses an interpretive case study to explore the current situation of its target product, which helps to get to the heart of the problem from multiple perspectives and conduct a deeper study (Drew, 2023).

From the point of view of functional comfort, massage can effectively improve the daily programmes of people who are physically tired and psychologically anxious (Soden, 2004). It can also significantly improve blood circulation in the body and improve the quality of sleep (Samuel et al., 2021). The optimal product related to massage is the massage chair, which is very much in line with the current need for convenience (Smith, 2022). Therefore, massage chairs are among the best choices (see Figure 2a).

From the perspective of available phototherapy products, SAD lamps are the most common and effective for treating seasonal affective disorder (Desan, 2007). However, the SAD lamps worldwide are relatively monofunctional (Roberts, 2023). They contain only three colour temperatures, two light colours - blue and warm - and differ only in shape (see Figure 3a). There are also rare nightlights with wireless charging for mobile phones (see Figure 3b). However, among the types of lamps, bedside lamps are the closest to the bed and provide relatively convenient lighting (see Figure 2b). Therefore, bedside lamps are among the best products (Di, 2023). The researcher can combine the form of bedside lamps with the function of SAD lamps and design the best product that can attract the target audience.

From the point of view of product convenience, the appearance of spectacles is one of the products that can have the most direct impact on the eye area, with the added advantage of portability. PEGASI, for example, is similar to eyeglasses in terms of appearance and function; it can treat people's disturbed biological clocks (Bioclock, 2024). The red light promotes sleep, and the green light refreshes the mind. Therefore, spectacles can be optimally combined with light effects (see Figure 2c).



Figure 2a Best Massage Chairs, 2024, based on OGAWA, Available from: <https://ogawaworld.co.uk/>



Figure 2b Golden Brothers-Bob, 2020, based on QeeBoo, Available from: <https://www.qeeboo.com/en/products/>



Figure 2c PEGASI Smart Sleeping Glasses - Dream Mirror, 2020, based on PEGASI, 2016, Available from: <https://www.pegasiglass.com/product/mengjing/>



Figure 3a 10000 Lux Light Therapy Lamp, based on Amazon, 2020, Available from: <https://www.amazon.co.uk/>



Figure 3b Plat Table Lamp, based on Fine Lumens, 2018, Available from: <https://www.amazon.co.uk/>

4.2 Semi-structured interviews

Semi-structured interviews are also one of the more common research methods and are qualitative (Horton et al., 2004). Its researcher needs to outline the interview before the interview and can be flexible according to the content of the interview. In this way, the researcher will get diverse and innovative answers (Diefenbach, 2009). Firstly, due to the cost of conducting the study due to geographical constraints, the participants were all Chinese postgraduate students enrolled at the University of Leeds and a snowball sampling method was used to recruit 30 participants whose daily sleep quality was inconsistent. Their ages ranged from 26 to 30 years old, and from these, 20 were selected who had slept less than 7 to 9 hours in the last week, with a 50/50 split between males and females. Secondly, during the study, the researcher was required to take notes or video recordings of the interviews in time for repeated viewing and data analysis. Finally, descriptive statistical analyses were used to generalise the data collected from the interviews and summarise their main characteristics.

4.3 Focus group

Focus groups are qualitative methods that mainly bring together small groups of people, such as a few professionals or enthusiasts, to discuss certain issues in a relaxed environment (Schildmeijer et

al., 2013). Compared to semi-structured interviews, these individuals can provide more detailed advice, and more direct comparisons can be drawn from the findings. Their limitation is that they are small in number and can only represent the common opinion of the group (George, 2022).

Firstly, to reflect the more precise results of the iterative test, the researcher selected six Chinese graduate students of design majors in school between the ages of 26-30 years old by purposive random sampling method and formed a focus group for the data collection of opinion feedback.

Secondly, as the organisers were all design students, the researcher then randomly selected three female and three male students with relatively high professional grades.

Finally, the data collected from the panel evaluation was still summarised using descriptive statistical analysis, as well as a comparative approach to assess the strengths and weaknesses of the three design concepts. As a result, the final design concepts were selected for optimal functionality through targeted iterative testing by the panel of experts.

5 Findings

5.1 Data Analysis

Before conducting the interviews, the researcher needed to design an outline for the interviews (Horton et al., 2004). The interview outline was divided into two parts: one part was to determine if the participants were active in using the sleep product through sleep quality; the other part was to collect data on the participants' preferences for the appearance and functionality of the product design. The results of the data are analysed below:

5.1.1 Participants' positive level of sleep product use

Sleep quality data analysis

According to research surveys, normal people sleep between 7-9 hours (Peter, 2023). Meanwhile, based on the criteria of the pre-recruitment participants, none of the 20 people selected had a quality sleep per se, i.e., less than 7 hours, but still 20 per cent of them had worse quality sleep, i.e., less than 5-6 hours. Therefore, from the data, it can be analysed that the quality of sleep of adults nowadays is rather worrying (see Figure 4).

It is known through the Scarcity Principle of economics that the less a person can satisfy their desires, the more they will want it. The higher the probability that a person with poor sleep will have thoughts and impulses to use a sleep aid (Boyle, 2024).

However, there are two sides to everything (Zwadlo, 2022). Because the product was designed for more than just a single sleep function based on the purpose of this study, people who sleep well may also use it because they want to protect their eyes or because they like the extra features of the product. Therefore, participants who chose to sleep poorly would be likelier to want to use the target product (Eslamian, 2017).

Activity in using the product

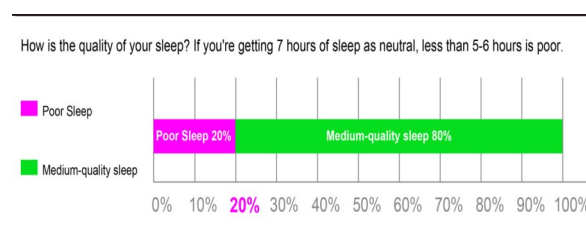


Figure 4 Data graph of sleep quality

As seen in Figure 5, the majority of the participants were still active in the use of sleep products 70%, but 30% of them felt that the sleep products were optional for them, as it was known from the interviews that these people knew the reason for their insomnia but could not execute their normal biological routine. Conversely, since the starting point of the product design was to achieve functional versatility, it is possible that the participants needed to be more positive about using the product to the extent that it was used to help them sleep. They may have found the new product useful for functions other than the main one, leading to a less pure, purposeful use. Therefore, this part of the data only illustrates the benefits of functional diversity in products that can cater to more than just a small audience segment (Wedowati et al., 2020).

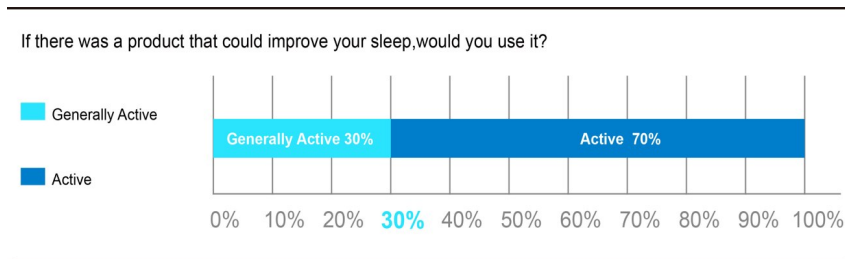


Figure 5 Participants' positive level of sleep product use.

5.1.2 Participants' favourite types of product appearance and functionality

Favourite style of design

As seen in Figure 6a, due to the different personal preferences of the participants, the majority, 90 per cent, considered the shape design extremely important. The number of neutral people and those who did not think it was important were the same at 5 per cent each. However, Figure 6b shows that 60 per cent of the people believed that the shape of the design was curved and rounded, which was most appropriate. Also, 35% expressed that cuteness can heal people's hearts. Therefore, only 5% of the people chose straight, angular shapes. Shape is the key to evoking emotional resonance. However, it can be seen from the question on the right side in Figure 6 that there is a semi-open pattern. Therefore, the answers received by the researcher were variable and extremely rich (Kallio, 2016). However, just from the succinct word Cute, it can be realised that this is a keyword extracted from the linguistic information of the subjects. This shows that it requires the researcher to be able to summarise a large amount of information into keywords and places a very high demand on his or her qualities. On the contrary, if the conclusion is shorter, it will lead to clearer objectives, loss of important information points, and failure to show a deep understanding of the content (Harish, 2024). Types of product multifunctional design preferences.

As shown in Figure 7a, during the interviews, the participants wanted a diversity of features for the target product. To achieve this, it is necessary to maintain a relatively active atmosphere. This is

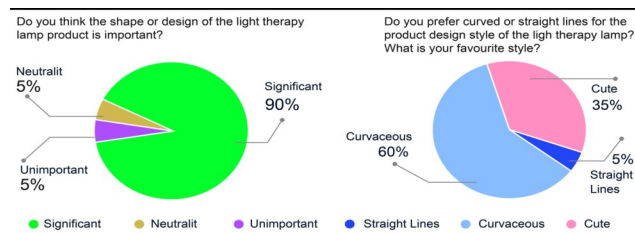


Figure 6a Degree of importance of the design shape

Figure 6b Favourite style type of design

because the Matthew effect in economics illustrates that if one has certain advantages, his/her individual will gain more opportunities and resources as a result (Farys, 2021). Therefore, the more relaxed the participants were, the more creative they could be with their product features. The types of features were ranked in the following order of prevalence (see Figure 7b).

Firstly, 35 percent of the target audience demands music. This is because music entertains the target audience and relieves their tense body and mind, a kind of silent language (Steen, 2021).

Secondly, the automatic mode, with a share of 30 percent, is a feature attached to the product that can be stopped or started automatically to respond more efficiently to the needs of the customer (Zwadlo, 2023). This is especially important when designing this sleeping product. When falling asleep, it is more important to automatically extinguish the light to ensure the sleep of adults.

Thirdly, the mode of the alarm clock accounts for 25%. According to a survey, the more problematic sleepers are, the more frequently they use alarm clocks, which ensures that people have a normal biological clock (Bioclock, 2024). However, the alarm clock of the product designed for this study can also go off with a wake-up mode that simulates sunrise blue light (Medina, 2023).

Fourth, voice control mode. Since voice technology appeared in 2010 and the cost of the technology is relatively high, it is not affordable for everyone (Yanbin, 2020). Therefore, the number is only 5 percent. In today's fast-paced era, voice mode is the interaction between devices and services that people connect with their voice to enhance the user experience of the product and make the use of features easy and time-saving (Isaac, 2024).

Fifthly, aromatherapy, although the number of people is only 5%. However, this feature also has a sleep-aiding effect, reducing anxiety and providing a deeper level of relaxation (Bedosky, 2022).

Therefore, since the subjects were adult people, the choice of features in these products was more in favour of intelligent ones. On the contrary, the operation of intelligent products can also be limited. For example, due to technology's limitations, the accuracy of voice interaction may malfunction during the use process. Therefore, the touch screen or button mode setting is necessary when designing the product (Aktas, 2021).

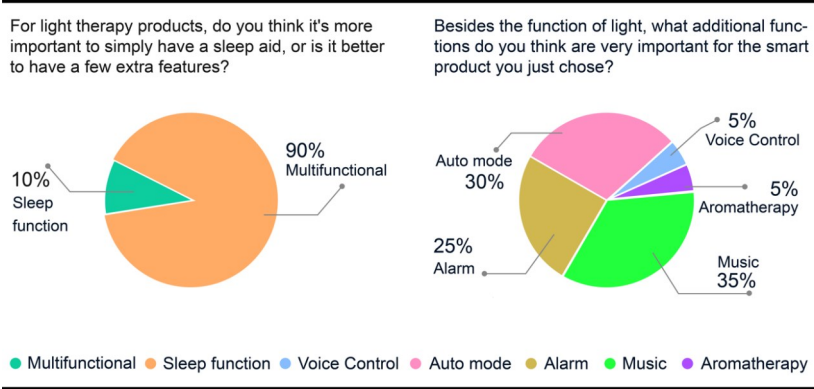


Figure 7a Participants' preference for single and multi-functional products

Figure 7b Participants' type preferences for multifunctionality

5.2 Evaluation analysis of iterative testing

This part of the data is mainly iterative testing done through focus groups. The data obtained from Figure 8 shows that as a result of the discussion among the six people in the professional group, five of them chose the bedside lamp, accounting for 83% of the total. The reasons for this were the cuteness of the shape, the cure, and the versatility and portability of the product's features. On the contrary, only one person chose the massage chair, accounting for 17%. This was because

most of the sessional panel needed to recognise the massage chair, which was too large and took up too much space. Meanwhile, this person suggested that the disadvantage of bedside lamps is that the convenience of charging mobile phones will speed up the frequency of using mobile phones before going to bed, which is a nuisance to the original intention of the design.

Therefore, the researcher once again made a targeted enhancement to the design in response to the shortcomings of the bedside lamp proposed by the professional panellists, i.e., the cover at the head charging place is set with a time to control the frequency of use by the target group. In addition, one person did not choose the eyeglass massager because of the lack of highlights compared to the previous two concepts.

Due to work time constraints, this study phase was not tested in multiple iterations. Some potential loopholes that were not identified may require refinement and supplementation at a later stage.

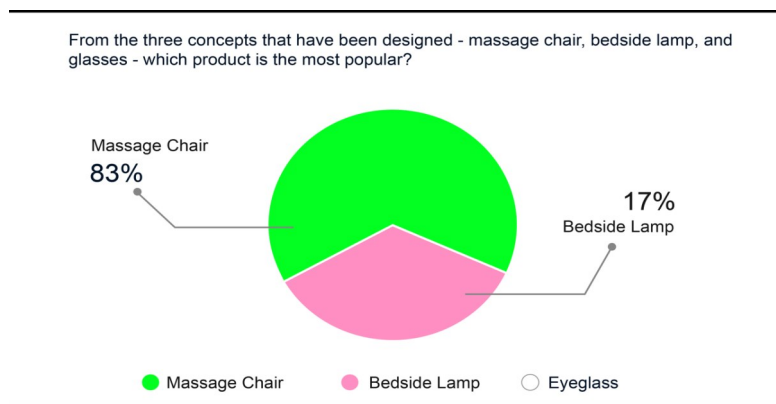


Figure 8 Product Favouritism Bias for Iterative Exploration.

6 Discussion and Conclusion

The findings of the data analysed in the preliminary stage of this study provide relatively professional information on the shape and style of the product function in the later stage.

Firstly, in terms of the product's shape, curves can arouse the participants' emotional resonance and reduce unnecessary scratches of people. Therefore, the researcher used curved shapes as much as possible in the design of this product to shape the outer contour. In terms of product functionality, participants preferred the feeling of comfort zones, such as aromatherapy and automatic mode functions. Most participants said that if a product has multifunctionality, it will increase their desire to buy it. Therefore, the researcher will try to achieve a perfect fit between form and function regarding product design.

Secondly, three products to be studied, massage chairs, bedside lamps and sleep aid glasses, were analysed from the previous case study evaluation. Their advantages are fashionable appearance, lazy mode, creative appearance, easy to carry, etc. The disadvantage is that they are all relatively single-function. However, compared with the data findings in this study, the previous products focus more on their function, while today's youth need more diversified products to ensure convenience. Therefore, the researcher will extract its advantages and enhance its disadvantages and then combine the specific data analysed to design a sleep aid product that meets the needs of adults today.

Finally, this research is designed with the understanding that it is not all about adding features to the product. Rather, it is important to consider the harmony between the appearance of the product

and its function, whether the shape of the product will be unconsciously injurious to the target population, and the reasonableness of the design of the product's lighting effect without harming the physical and mental health of the target population (Dianat, 2018). This research highlights the light therapy sleep aid function of this product.

Therefore, in future research, the design needs to be made into a physical prototype so that the participants are not just looking at it but need to feel and experience it (Li, 2022). As Hennig (2016) shows, an in-depth understanding of users and preferences is necessary to make the design as pleasing as possible to the layperson, making the design more intriguing and relevant to people's needs.

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