

**A STUDY ON THE EFFECT OF
ATTRACTIVENESS, PRAGMATIC, AND
HEDONIC QUALITY ON THE USER
EXPERIENCE OF A DARK MODE MOBILE
READING APPLICATION ON YOUNG USER IN
CHINA**

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UNIVERSITI SAINS MALAYSIA

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CHINA**

by

YANG AIYI

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LIST OF ABBREVIATIONS

UEQ	User Experience Questionnaire
USE	Usability, Satisfaction, and Ease of use
HCI	Human-Computer Interaction

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**KAJIAN TERHADAP KESAN KUALITI DAYA TARIK, PRAGMATIK DAN
HEDONIK PADA PENGALAMAN PENGGUNA APLIKASI BACAAN
MUDAH ALIH MOD GELAP DI KALANGAN PENGGUNA MUDA DI
CHINA**

ABSTRAK

Konsep mod gelap mula diperkenalkan pada peringkat awal pembangunan paparan komputer. Dengan kemajuan dalam teknologi skrin dan penyebaran peranti mudah alih, mod gelap mula mendapat perhatian semula pada awal abad ke-21. Menyentuh tahun 2019, iOS 13 dan Android 10 memperkenalkan mod gelap secara sistemik, menjadikan ciri ini meluas pada peranti mudah alih utama. Meskipun mod gelap telah diterima secara meluas dalam sektor komersil, kajian akademik berkaitan mod gelap, khususnya dari aspek pengalaman pengguna, masih terbatas. Kajian ini meneliti dimensi Tarikan, Kualiti Pragmatik, dan Kualiti Hedonik dalam pengalaman pengguna mod gelap aplikasi bacaan mudah alih di kalangan pengguna muda di China. Menggunakan metodologi penyelidikan campuran, data dikumpulkan berdasarkan kerangka sistematik dan teori UEQ. Kajian selidik kuantitatif mengukur pengalaman pengguna melalui tiga kategori UEQ (enam atribut), dan temu bual kualitatif digunakan untuk triangulasi hasil. Penemuan menunjukkan bahawa Tarikan mendapat maklum balas tertinggi, Kualiti Hedonik terendah, dan hasil Kualiti Pragmatik adalah sederhana tinggi. Secara khusus, terdapat perbezaan subjektif antara hasil soal selidik dan temu bual untuk Kualiti Hedonik. Kajian ini memberikan pandangan bernilai untuk pereka dan pembangun untuk meningkatkan pengalaman pengguna mod gelap, menyediakan data rujukan dan cadangan untuk penambahbaikan kecukupan reka bentuk. Ia juga mengisi jurang dalam penyelidikan pengalaman pengguna muda

dengan aplikasi bacaan mudah alih dalam mod gelap dan berfungsi sebagai rujukan untuk penyelidikan masa depan.

**A STUDY ON THE EFFECT OF ATTRACTIVENESS, PRAGMATIC, AND
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MOBILE READING APPLICATION ON YOUNG USER IN CHINA**

ABSTRACT

The concept of dark mode originated in the early development stages of computer displays. With the advancement of screen technology and the proliferation of mobile devices, dark mode regained attention in the early 21st century. Notably, in 2019, iOS 13 and Android 10 introduced system-wide dark modes, making this feature prevalent on mainstream mobile devices. Although dark mode has become widely adopted commercially, academic research on dark mode, particularly regarding user experience, remains limited. This study investigates the dimensions of Attractiveness, Pragmatic Quality, and Hedonic Quality in the dark mode user experience of mobile reading applications among young users in China. Using a mixed research methodology, data were collected based on a systematic framework and the UEQ theory. A quantitative questionnaire survey measured the user experience across three UEQ categories (six attributes), and qualitative interviews were used for triangulation of the results. Findings indicate that Attractiveness received the highest feedback, Hedonic Quality the lowest, and Pragmatic Quality results were moderately high. Notably, there were subjective differences between the questionnaire and interview results for Hedonic Quality. This study provides valuable insights for designers and developers to improve dark mode user experiences, offering reference data and suggestions to enhance design effectiveness. It fills a research gap regarding young users' experiences with mobile reading applications in dark mode and serves as a reference for future research.

CHAPTER 1

INTRODUCTION

1.1 Chapter Introduction

This chapter initially describes the relevant background pertaining to dark mode, including the definition of dark mode, the correlation between Chinese youth and dark mode, and the connection between dark mode and reading software. Subsequently, the background of this study is stated, including the problems faced and gaps in research. Further, the objectives and research questions of the study are proposed. Finally, the significance of the research is summarised.

1.2 Background

1.2.1 Background of Dark Mode Development

The use of dark mode originated in the early stages of computer monitor development. During that time, computers utilized displays with green or white text on a black background, primarily due to technological limitations and energy-saving considerations (Henriette & Felix, 2020). In the 1980s and 1990s, as graphical user interfaces (GUIs) evolved, the white background with black text, known as "light mode," gradually became mainstream. This mode closely resembled text on paper, making it easier for users to adapt to, thereby replacing dark mode (Perry & Voelcker, 1989).

However, with advancements in screen technology and the proliferation of mobile devices, dark mode regained attention in the early 21st century. The widespread use of smartphones and tablets, which often leads to eye strain during prolonged usage,

highlighted the benefits of dark mode, such as reducing blue light and lowering screen brightness (Kaur et al., 2022). As a result, dark mode became a popular display option (K. Kim et al., 2019). Google's Android system introduced a dark mode option in 2014 (Ma et al., 2023). In 2018, macOS Mojave launched a system-wide dark mode, marking its extensive application (Apple Developer, 2018). By 2019, both iOS 13 and Android 10 had introduced system-wide dark modes, making the feature widespread on mainstream mobile devices (Cobalt Sign, 2019). From 2020 onwards, an increasing number of applications and websites began to support dark mode (Lindner, 2024).

1.2.2 Chinese Youth and Dark Mode

In recent years, dark mode has increasingly favoured by young people in China. This trend is partly due to the visual benefits and comfort advantages by dark mode (Pedersen et al., 2020). Dark mode reduces screen brightness and ocular photostimulation, providing a more comfortable reading environment, especially in low-light or night-time conditions (Chellappa et al., 2011). Concerning the young Chinese demographic, they embody one of the most active user groups within the Chinese mobile internet domain (CNNIC, 2022), directly influencing trends in mobile app and smartphone usage, including the widespread acceptance of dark mode (Virtanen, 2023). For instance, dark mode is extensively applied in social media apps, news reading apps, and e-book reading apps, some of the most frequently used mobile apps among Chinese youth (Y. Lu et al., 2010). In China, young consumer groups have a strong demand for better visual comfort and experience (Rob & Alistair, 2020). Studies have shown that compared to consumers in other age groups, young consumers are more willing to embrace new consumption trends and technologies (D. Lu et al., 2019), such as dark mode. Consequently, mobile app developers in China must consider the

preference for dark mode amongst the young people, integrating this mode within their applications to attract this consumer group.

1.2.3 Reading Apps and Dark Mode

Within the prevailing tech riptide, dark mode, as a user interface design trend, equips reading applications with a fresh user experience. In recent years, numerous reading applications like Kindle and Readmoo have already begun to support dark mode, particularly showing significant advantages in reducing visual fatigue, conserving battery life and improving reading experience in dark environments (K. Kim et al., 2019). At present, in China, several mobile reading applications, such as WeChat Reading, iReader, Qidian, and Tomato novels, amongst others, have implemented Dark Mode within the context of reading scenarios (The Painted Scholar, 2020; Today's headline, 2023). However, only "WeChat Reading" sports Dark Mode throughout all its scenarios, such as bookstores and bookshelves. Besides "WeChat Reading", the full-scene dark mode option remains undeveloped and unformulated in other reading applications (IT Home, 2019). Studies show that contrast heightens at lower stimulant intensity, i.e., lower brightness, which contribute to reduce symptoms of visual fatigue and insomnia (Chung, 2011). Hence, dark mode is warmly welcomed and widely advocated in numerous domains, especially in mobile reading applications. The adoption of dark mode in reading applications on smartphones, which affects user interface colour, contrasts, and overall design, may have profound implications for the reading experience of young Chinese readers. For night-time reading, dark mode could exert a more prominent effect on the comfort of the eyes, especially for young people who frequently read on their mobile phones during night hours (Virtanen, 2023).

The application of dark mode in reading software is tightly linked to user visual comfort and directly impacts user actual experience and satisfaction. Regarding the Chinese youth, their expectations from reading software encompass feelings during usage. Only through a comprehensive understanding of these dimensions might one offer guidance conforming to user expectations in reading software design. This could serve as a reference for reading apps that have not presented an all-scenario dark mode option, thereby weighing the need for multiple dark mode configurations to enhance user reading experiences under various circumstances.

1.3 Research Gap

Since the release of dark mode systems by Apple and Android, dark mode has been widely adopted across various industries (Henriette & Felix, 2020). In recent years, The technology equipment and internet industries have introduced dark mode into their operating systems and applications, highlighting the significance of potential changes in visual design (Ma et al., 2023). Dark mode has become increasingly prevalent in daily life, particularly in the evening or low-light environments. However, dark mode is a relatively new concept emerging from commercial products and related industries, and most design guidelines for dark mode are technically oriented (Android Developer, 2022; Apple Developer, 2022). Academic research on dark mode is limited, and there are notable differences between academic studies and commercial solutions. From a commercial perspective, the focus tends to be on product functionalities and profitability, often at the expense of thoroughly considering user needs. Conversely, academic research emphasizes the quality of user experience and the impact of products on users (Ray Poynter, 2014). While commercial practices and innovations may lead academic research in efficiency, academic studies provide more scientific,

rigorous, and user-centered insights that can better guide commercial practices. Consequently, there is a lack of comprehensive user experience reports on dark mode, not only in academia but also in related industries.

Current academic research on dark mode mainly explores its various characteristics (Henriette & Felix, 2020; Wilson, 2018), including its physiological and psychological impacts on users (Erickson et al., 2020; Löffler et al., 2017). Some studies have also examined the cultural context of dark mode usage. However, several significant research gaps remain.

Firstly, there is a lack of sufficient academic research on dark mode. Although dark mode has achieved some success in commercial applications, current studies have not thoroughly explored the academic background, theoretical support, and its position within user experience research frameworks. This represents a critical research gap. Existing research tends to focus on functional and isolated aspects of dark mode, lacking a comprehensive approach from the overall perspective of user experience (Pedersen et al., 2020). Moreover, there is a paucity of evaluations on the quality of user experience with dark mode.

Secondly, studies targeting different user groups are scarce, resulting in a lack of reference data for optimizing the dark mode user experience. Existing literature on dark mode largely lacks comprehensive investigations into different user groups. By neglecting the unique needs and preferences of diverse user groups, there is insufficient reference data for enhancing the broader user experience of dark mode. Most studies focus on the effects of dark mode on visual comfort and readability (Chatrangsan, 2023), primarily concentrating on older user groups (Lin & Yeh, 2010; Tomioka, 2007), with few studies on optimizing the reading experience for younger users. Given that

younger users are inherently more receptive to technology and new experiences, it is crucial to understand their acceptance and psychological perceptions of dark mode and whether it genuinely enhances their reading experience. Notably, according to Google Trends in 2022, China ranks as the second most interested country in dark mode (Google, 2022). Dark mode is popular in China and has garnered significant attention from Chinese users, providing valuable user experience data for research. However, there is a lack of empirical studies on the use of dark mode by young Chinese readers. Current feedback on dark mode among Chinese users is not entirely satisfactory (Shen, 2019). Yet, no studies have indicated whether the use of dark mode in mobile reading applications genuinely improves the reading experience of young Chinese users, nor have they examined potential negative impacts. There is also a lack of detailed understanding of the cognitive, emotional, and user experience aspects of Chinese users reading in dark mode.

Finally, there is a lack of in-depth exploration of the impact of dark mode on the reading experience. Existing studies on the impact of dark mode on user experience often focus too heavily on the factors influencing users' choice between dark and light modes, without delving into whether dark mode truly enhances the reading experience and the specific forms of improvement (Apraiz Iriarte et al., 2021; Hakobyan & Saha, 2021). There is also a dearth of studies on the effectiveness and user experience of dark mode in actual reading scenarios, such as whether dark mode improves comfort, enhances focus, or boosts reading efficiency (Bernal-Molina et al., 2019; A.-H. Wang & Chen, 2000). This missing perspective limits the understanding of the potential benefits of dark mode.

1.4 Problem Statement

Based on the literature review and identified research gaps, it is evident that one of the significant trends in mobile device and application interface design in recent years is the adoption of dark mode. Dark mode has positively impacted visual comfort, battery life conservation, and enhanced visual experience in low-light environments, especially for users who frequently read on their phones at night (Chung, 2011; Pedersen et al., 2020). Many popular mobile applications and websites have started to support dark mode (Azimov, 2020).

In China, the strong demand for enhanced visual comfort and experience among young consumers has driven changes in the usage trends of mobile applications and smartphones. This demographic is one of the most active user groups in China's mobile internet landscape, directly influencing market trends (T. Gao et al., 2010). As prolonged use of electronic devices becomes the norm, young people are increasingly concerned with visual health and comfort. Dark mode has thus gained popularity for its effectiveness in reducing eye strain, decreasing blue light output, and providing a more comfortable browsing experience at night (Mahmood et al., 2023). These features have led to the rapid adoption of dark mode among this group. Moreover, dark mode significantly reduces power consumption on devices using AMOLED screens, thereby extending battery life, which is crucial for young people who rely on smartphones for daily tasks (X. Chen et al., 2013). At the same time, dark mode aligns with the youth's pursuit of personalization and fashion, offering a visually appealing and modern interface design option (Zhi Yan Zhan, 2024). Studies indicate that young consumers have a high acceptance of new technologies and features, especially those that enhance user experience and health benefits, which further promoting the

widespread acceptance and adoption of dark mode (CNNIC, 2022; Virtanen, 2023). However, there is still a lack of research on how young people in China perceive dark mode and its role in improving visual experience and reading satisfaction.

Many current studies have explored various attributes of dark mode (Ma et al., 2023), focusing mainly on its advantages in visual comfort and battery life conservation. However, they have overlooked its potential to enhance design attractiveness, increase practicality, and improve hedonic quality. Dark mode may have a significant impact on improving the reading experience, and these three aspects qualities that are critical to the user experience. Therefore, sufficient attention should be given to dark mode's attractiveness, pragmatic quality, and hedonic quality.

Regarding dark mode's attractiveness, most existing studies focus on visual comfort and readability but fail to deeply explore whether dark mode can increase the overall attractiveness of applications. Attractiveness involves not only visual comfort but also user satisfaction and pleasure with the interface design (Hassenzahl, 2004). For young users, whether dark mode can enhance their interest and satisfaction in using the application requires further research. Pragmatic quality, a core component of user experience, involves the efficiency and effectiveness of users completing specific tasks (Nielsen, 1997). Using dark mode at night or in low-light environments can reduce glare and improve visual clarity, potentially enhancing reading efficiency (Bernal-Molina et al., 2019). However, current research has not sufficiently validated these hypotheses and lacks empirical data on young Chinese users. Studying the practicality of dark mode can help understand its advantages and potential issues in actual use, providing a basis for design optimization. Hedonic quality involves the emotional and pleasurable experiences of users during use, a crucial aspect of user experience

research (Hassenzahl, 2009). Exploring whether dark mode can enhance users' pleasure, reduce fatigue during use, and its impact on users' emotions is worthwhile. Particularly for young users, dark mode may evoke different emotional reactions and usage experiences, which is critical for understanding their comprehensive user experience. More academic discussion on dark mode will help establish a more comprehensive and in-depth research system. Therefore, studying user experience with dark mode in these three aspects is valuable, as there are no clear answers yet, whether in attractiveness, pragmatic quality, or hedonic quality.

This study aims to address the research gaps in attractiveness, pragmatic quality, and hedonic quality. It includes an in-depth exploration of the specific roles of dark mode in enhancing the attractiveness, practicality, and hedonic quality of reading applications through the experience of young Chinese users. This study will provide a more comprehensive and systematic understanding of the user experience of dark mode in mobile reading applications among young Chinese readers, while also offering a richer theoretical and practical foundation for future dark mode research.

1.5 Research Objectives

The primary objective of this study is to investigate the user experience of young Chinese users with reading applications in dark mode across three core dimensions: attractiveness, pragmatic quality, and hedonic quality.

1. To identify the attractiveness of the user experience for young Chinese users using reading applications in dark mode.
2. To examine the pragmatic quality of the user experience for young Chinese users utilizing reading applications in dark mode.

3. To analyse the hedonic quality of the user experience for young Chinese users using reading applications in dark mode.

Regarding the first objective, attractiveness significantly influences users' initial impressions and overall satisfaction with an application. For young users, the visual appeal of an interface is a critical factor in their decision to start and continue using an app (Hassenzahl, 2004). This study seeks to determine whether dark mode enhances the overall attractiveness of reading applications, thereby increasing their popularity and acceptance among young users. By investigating and analyzing users' evaluations of the visual design in dark mode, the study aims to understand whether the introduction of dark mode makes reading applications more appealing, encouraging prolonged use and enhancing the reading experience.

Concerning the second objective, pragmatic quality is a core component of user experience, relating to the efficiency and effectiveness with which users can complete specific tasks (Nielsen, 1997). The performance of dark mode in practical use directly affects reading efficiency and experience in varying lighting conditions. This research will explore whether dark mode improves task completion efficiency and effectiveness within reading applications, providing insights into its positive impact on actual usage.

For the third objective, hedonic quality pertains to the emotional and pleasurable aspects of the user experience, which are crucial in user experience research (Hassenzahl, 2009). The study will analyse whether dark mode enhances users' enjoyment, reduces fatigue, and positively affects emotional and psychological responses. By delving into the mechanisms by which dark mode influences emotional experience, this research aims to explore its impact on users' emotional states and overall satisfaction.

1.6 Research Questions

Based on the above research objectives, this study proposes the following specific research questions:

1. How attractive is the user experience for young Chinese users utilizing reading apps in dark mode?
2. What is the pragmatic quality of the user experience for young Chinese users using reading apps in dark mode?
3. How does the hedonic quality of user experience fare among young Chinese users utilizing reading apps in dark mode?

For the first research question, attractiveness encompasses not only visual comfort but also users' satisfaction and pleasure with the design (Hassenzahl, 2004). Existing studies have not thoroughly explored whether dark mode can enhance the overall attractiveness of an application, which is particularly important for the young user demographic. Therefore, it is necessary to understand whether the introduction of dark mode can improve the appeal of reading applications. How does dark mode influence the attractiveness of reading applications?

Regarding the second research question, exploring the pragmatic quality of dark mode is essential because previous studies have shown that dark mode usage in low-light environments can improve visual clarity, potentially increasing reading efficiency (Bernal-Molina et al., 2019). However, while reading efficiency is one aspect, performing tasks in a reading environment is also a challenge that has not yet been verified. This study will analyse whether dark mode enhances reading efficiency and reduces eye strain in reading applications. Does dark mode improve task

completion efficiency and effectiveness in reading applications?

For the third research question, understanding the hedonic quality of the dark mode user experience is critical. Prior research does not clearly indicate whether dark mode can provide a more enjoyable reading experience, alleviate visual fatigue, and reduce emotional burden, all of which directly influence long-term usage and satisfaction. This is especially relevant for young users who frequently use reading applications. Dark mode may evoke different emotional responses and user experiences, making it vital to comprehensively understand its impact on the overall user experience. Does dark mode enhance users' enjoyment? What are the mechanisms by which dark mode affects users' emotional and psychological experiences?

By systematically exploring these three aspects, this study aims to gain a comprehensive understanding of the effectiveness of dark mode among young users in China, providing valuable insights and guidance for the design of reading applications.

1.7 Research Scope

Dark mode is indeed adapted in many different scenarios, commonly in the interfaces of various websites and applications. Although this study aims to comprehensively analyse the impact of dark mode on user experience, due to time and user group limitations, this research mainly focuses on the influence of dark mode on the user experience of Chinese young users with reading applications, emphasizing three primary dimensions: attractiveness, pragmatic quality, and hedonic quality. The research sample is young users in China, primarily focusing on the age group of 18 to 40 years.

As dark mode relates to user experience, human-computer interaction, and

optical technology, this study conducts a review of relevant literature to obtain richer and more objective content on dark mode. Furthermore, since dark mode is more prominent in the commercial sector currently, this study also reviews data and reports from dark mode applications in related industries. These data are crucial for understanding the current development status of dark mode and user feedback. As Dark Mode covers a number of industry sectors, it is not possible to be fully explored regarding its user experience, and therefore this study cannot cover the user experience of Dark Mode within all industry products, focusing only on the user experience of using Dark Mode in mobile phone reading apps, and focusing on the WeChat Reading reading app. WeChat Reading is one of China's leading reading applications, ranked among the top three, and is the only reading application in China that supports dark mode for all reading scenarios. Therefore, this study examines the effect of dark mode in reading applications on user experience within WeChat Reading to evaluate its user experience quality.

Although the scope of research subjects is narrowed, the research employs a combination of questionnaire surveys and interviews to collect more detailed data and process the data, providing comprehensive explanations of users' preferences and experiences with dark mode. Finally, the research findings will offer theoretical and practical guidance for the design and optimization of dark mode in mobile reading applications, aiding in a broader understanding of the role of dark mode in enhancing user experience with reading apps, and providing practical suggestions for developers to optimize design and improve user satisfaction.

1.8 Research Methodology

This study adopts a mixed research method, combining qualitative and

quantitative research to deeply understand users' experiences with reading applications in dark mode. The research first designs a quantitative questionnaire based on the User Experience Questionnaire (UEQ) framework to quantitatively assess the user experience of dark mode. Subsequently, qualitative interviews are conducted to further explore issues identified in the questionnaire survey and gather users' specific feelings and suggestions.

The study subjects are young users aged 18-40 in Shenzhen, China, with WeChat Reading selected as the research object due to its top three download ranking in China and comprehensive support for dark mode. Shenzhen is chosen as the research location due to its large proportion of young people, diverse population, and advanced technology, ensuring the richness and representativeness of the data. The experiment is conducted in the laboratory of the Humanities Building at Shenzhen University, ensuring the standardization and systematization of the research process.

The research sample is selected through purposive sampling, with participants recruited from reading organizations in Shenzhen via their management. The sample size is determined using the GPower tool, resulting in a questionnaire survey sample size of 384 and an interview sample size of 45.

The questionnaire design includes basic information collection and quantitative questions based on the user experience questionnaire framework. The final questionnaire is distributed via Google Forms, with data collected and imported into Excel for processing and analysis. Quantitative data is analysed statistically to draw preliminary conclusions, while qualitative research employs semi-structured interviews to further explore users' feelings and suggestions about dark mode and identify future improvement strategies.

By combining quantitative questionnaire surveys and qualitative interviews, this study obtains comprehensive data and in-depth insights. The quantitative questionnaire provides a broad understanding of user experience, while the qualitative interviews delve into specific issues and user suggestions. The complementarity of these methods ensures the breadth and depth of data, making the research results more reliable and complete, providing scientific basis and practical suggestions for improving the user experience of dark mode in mobile reading applications.

1.9 Terminology Definitions

1.9.1 Dark Mode

Dark mode, often referred to as "Black Mode" or "Night Mode", is a display setting for the graphical user interface, whose design philosophy stems from visual comfort and reading usability (Pedersen et al., 2020). In dark mode, the theme colour of the interface is typically black or dark, and the text and icons are of light colours. This inverted colour configuration, characterized by its stark contrast, is perceived to be in line with the visual habits of human eyes in low-light conditions, reducing the level of eye strain during prolonged reading or viewing of the screen.

Researchers have defined and compared dark mode and light mode from the aspect of contrast polarity (Buchner et al., 2009; Lin & Yeh, 2010; Piepenbrock et al., 2014a), proposing that dark mode represents negative contrast polarity, indicative of a combination of bright text on a dark background (S. Gao et al., 2021; Mayr & Buchner, 2010). Conversely, light mode is characterised as positive contrast polarity (Chan & Lee, 2005; Dobres et al., 2017), referring to dark text on a light background.

Dark mode, also referred to as "Black Theme" or "Dark Theme," represents a style of interface design or, alternatively, a software option. It is characterised by altering a programme, website or system's light background to a darker colour, and switching the text from dark to light, thereby going against traditional colour combinations. Apart from the background and text, other components are not entirely the reverse of "Light Mode," although most are indeed darker (Christensson, 2018). Recently, dark mode has become a popular choice for all terminal users as it is now a standard option in Windows and macOS.

1.9.2 User Experience

"User Experience" (UX), according to the ISO 9241 international standard, refers to the perceptions and responses that result from the use or anticipated use of a system, product, or service. These perceptions and responses encompass pre-use expectations, satisfaction during interaction, and post-use reflections. The standard emphasizes that user experience is dynamic, evolving with time and environmental conditions (ISO, 2019). Additionally, ISO notes that user experience includes not only the immediate interaction but also pre-use expectations and post-use reflections, encompassing the emotional responses, memories, and evaluations associated with a product.

The Nielsen Norman Group defines user experience as encompassing all aspects of the end user's interaction with a company, its services, and its products. This definition extends beyond direct product interaction to include the user's perception of the company's public image and values, such as corporate responsibility and broader societal impact(Norman, 1998). User experience reflects not only the pleasure derived

from using a product but also deeper perceptions of brand image, social status, and lifestyle.

1.9.3 UEQ

The "User Experience Questionnaire" (UEQ) is a tool for measuring user experience, first introduced by Laugwitz, Held, and Schrepp in 2008. The UEQ offers a quick and cost-effective way to measure the user experience of a product or service in real-time (Laugwitz et al., 2008). In the UEQ, users evaluate a series of adjectives describing specific interactive experiences with a product or service. These adjectives cover six dimensions: attractiveness, perspicuity, efficiency, dependability, stimulation, and novelty. This tool aids in understanding users' attitudes, emotions, and experiences, providing potential insights for improving product design.

The UEQ is based on a series of adjectives and phrases that cover a full range of user experience characteristics, which are basically capable of comprehensively assessing the user's perception and experience of a product or service. Among them, Attractiveness evaluates whether the product attracts users; Pragmatic measures the speed and effectiveness of task completion as well as focuses on whether the product meets the user's functional usage needs, etc.; Stimulation refers to whether it can cause users to take risks and try new things; and Novelty focuses on whether the product has novel ideas or concepts.

The UEQ is widely applicable to various products or services, including websites, mobile applications, software interfaces, or any system involving direct user interaction. The UEQ offers a quantitative method for assessing actual user experiences, enabling designers and researchers to gather specific user feedback to

improve product design and enhance user satisfaction.

1.9.4 WeChat Reading App

WeChat Reading is an e-book reading application in China, providing readers with a wealth of reading resources, including a large collection of licensed books, novels, comics, public account articles, and audiobooks. It has received widespread acclaim from users, ranking among the top three in the Chinese reading app market (Qimai data, 2022).

WeChat Reading emphasizes simplicity and ease of use in its application design. Both the overall page design and specific user interface elements, such as icons and buttons, are thoughtfully considered to enhance the reading experience and make the app intuitive to navigate. The comprehensive support for dark mode has earned high praise from users, allowing readers to protect their eyes in darker environments while reducing device battery consumption. This feature demonstrates WeChat Reading's responsiveness to the evolving needs of its target user group and its commitment to user experience.

In summary, WeChat Reading's meticulous attention to user experience, multi-device synchronization, comprehensive support for dark mode, and rich content resources have positioned it as a leading player in the e-book market.

1.9.5 Contrast Polarity

"Contrast polarity" is a term used to describe the preference for display colors in interfaces. According to Aleman, Wang, and Schaeffel, contrast polarity refers to the color or brightness contrast between an image or visual stimulus and its background.

Their research indicates that changes in contrast polarity can impact the reading experience, highlighting its significant influence on reading (Aleman et al., 2018). Contrast polarity is typically categorized as either positive or negative. Positive polarity usually refers to dark text elements displayed on a light background, such as black text on a white background. Conversely, negative polarity involves light text elements displayed on a dark background, such as white text on a black background.

"Dark mode" is considered an example of negative polarity, utilizing dark backgrounds and light text. Research has shown that this color scheme can affect reading and comprehension efficiency. For instance, Piepenbrock, Mayr, and Buchner found that positive polarity displays (dark characters on a light background) may be more advantageous for small character sizes (Piepenbrock et al., 2014a). However, this is not universally applicable. For example, a study by Li et al. found that background color selection and brightness combinations significantly influence readability and subjective preferences in negative polarity displays (Li et al., 2022), including dark mode designs.

1.10 Research Significance

1.10.1 Academic Significance of the Research Data and Results

This study delves into the impact of dark mode on user experience, offering novel theoretical perspectives and empirical data. It enriches the understanding of dark mode and lays the groundwork for further research into user psychology and aesthetic preferences. Specifically, the findings provide the academic community with deep insights into the attractiveness, practicality, and hedonic quality of dark mode, thereby advancing theoretical developments and practical applications in the field.

1.10.2 Enhancing the Knowledge System of Dark Mode Experience

By analyzing the usage habits and preferences of young Chinese users in dark mode, this study offers valuable personalized data. This information helps designers and developers better understand the unique needs and aesthetic trends of Chinese users, optimizing product design and enhancing user satisfaction. Additionally, these data provide useful references for global product design, aiding international teams in balancing user needs across different cultural contexts and promoting the international development of products.

1.10.3 Indicative Significance for Future Application Development

By investigating the experiences of young Chinese users in dark mode, this study reveals feedback across multiple dimensions. This feedback provides valuable guidance for future application development, helping developers accurately grasp user needs and optimize products accordingly. The findings offer practical suggestions for designers and developers in areas such as attractiveness, clarity, and reliability, promoting the development of applications that are more efficient and aligned with user expectations.

1.10.4 Indicative Significance for Operating Systems and Single Applications

The results of this study highlight the necessity for devices to support dual modes (light mode and dark mode), revealing the advantages of dark mode in enhancing visual comfort, information clarity, and a sense of security. It is recommended that device manufacturers and application developers prioritize dual-mode compatibility in product design to meet diverse user needs and provide

personalized user experiences, thereby enhancing market competitiveness and user satisfaction.

1.10.5 Research Significance for Improving User Interface Design and User Experience of Reading Applications

This study holds significant implications for the user interface design and user experience improvement of reading applications. The findings indicate that dark mode scores higher in attractiveness, clarity, and reliability, making users feel more comfortable, facilitating information recognition, and fostering trust. Based on these results, developers are advised to prioritize dark mode design and integrate it across all scenarios of reading applications to enhance user experience. Additionally, addressing the shortcomings of dark mode in operational efficiency and innovative design, the study suggests various optimization strategies, such as simplifying operation processes and introducing creative design elements, to comprehensively enhance user experience.

1.11 Organisation of the thesis

This section demonstrates the entire process and framework for writing a thesis, identifies the topic of each chapter, and outlines the main elements to be accomplished in that chapter.

Table 1.11 Organisation of the thesis

Chapter	Titles	Overview of the content of the writing
Chapter 1	Introduction	Provide a background to the study, provide a problem statement, state the research objectives and research questions, set the scope of the study, explain the significance of the study and relevant terminology, and outline the research methodology.
Chapter 2	Literature Review	Provide an overview of the existing literature and theories related to the dark colour model, user experience (including theories from various different fields and research directions), and focus on the background of the UEQ research framework, related theories, attributes, categories, and their practicality and rationality for adoption in this study, in order to lay a theoretical foundation for the subsequent research.
Chapter 3	Research Methodology	Describes the methodology of the study, including the research design, methods of data collection and analysis, and explains the rationale for choosing these methods. Details of sample selection, questionnaire design and data analysis techniques are also included.
Chapter 4	Results and Discussion	Present research findings, including statistical analyses, graphs, and categorical tables, interpreting findings, comparing quantitative and qualitative research findings, and relating findings to research questions. Also discusses the relevance of past research's to current research findings in the context of research findings.
Chapter 5	Conclusion and Recommendations	Summarises the key findings of the study and explores the implications of the findings for theory and practice. Finally, acknowledge the limitations of the study and provide recommendations for future research and practical applications.

CHAPTER 2

LITERATURE REVIEW

2.1 Chapter Introduction

This chapter reviews and summarizes previous research regarding dark mode, user experience, and research frameworks to establish the theoretical foundation of the current research. The chapter deeply discusses the attributes of dark mode, its impact on individuals physiologically and psychologically, and how it is influenced by cultural customs, through systematic collation of relevant literature.

2.2 Dark Mode

2.2.1 Characteristics of Dark Mode

Dark mode, as an important element of interface design, has various characteristics that impact the user reading experience. When delving into the characteristics of dark mode, research needs to focus on its development trends, design characteristics, colour attributes, and the representation of interface elements. Henriette et al. discussed dark mode as a new trend, exploring its developmental background and driving factors (Henriette & Felix, 2020; Mantiuk et al., 2009), including technological advancements, device upgrades, and users' psychological effects and preferences. This indicates that dark mode is not only a result of technological development but also a product of user needs and market drivers. The colour tones of dark mode primarily consist of black and dark colours, contrasted by brighter whites or other vivid colours (Kohler & Zhang, 2023). This high-contrast colour scheme aims to reduce eye strain, especially in low-light environments. However, this contrast adjustment requires meticulous design; otherwise, it might

cause visual fatigue or affect readability (Muhamad & Amali, 2023). Therefore, while dark mode helps provide a more comfortable reading experience in low-light environments, its design needs to balance contrast and colour saturation to avoid potential negative effects. Whether there is technology to solve this problem still requires further exploration.

Secondly, the characteristics of dark mode also include the mechanism of switching between day and night modes. Some applications use automatic or manual switching modes to meet users' needs in different environments (Vasylevska et al., 2019). This switching mechanism design not only enhances user experience but also demonstrates the flexibility of dark mode in adapting to different usage scenarios. However, the implementation of automatic switching functions needs to consider usage duration, changes in ambient light, and individual user differences; otherwise, it may cause inconvenience or interfere with the user experience. Moreover, improper adjustment in practice may lead to user dissatisfaction, indicating that the switching mechanism of dark mode has complexity and challenges in real-world applications.

When using devices with OLED (Organic Light Emitting Diode) or AMOLED (Active-Matrix Organic Light Emitting Diode) screens, black pixels in dark mode require less energy compared to white pixels. Thus, this attribute of dark mode can help conserve battery power (Dong et al., 2009), offering advantages in reducing energy consumption and extending battery life (Dash & Hu, 2021; Wilson, 2018). Some users have confirmed that their devices consume power more slowly under the same usage conditions when using dark mode (J. Xu et al., 2019). This power-saving effect is attractive to users, but its effectiveness may vary across different devices and usage conditions, requiring further empirical research to verify these claims. However,