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THE INCREASING USAGE OF DARK MODE ON SMARTPHONES IN ADOLESCENTS

ӨСПҮРҮМДӨРДӨ СМАРТФОНДОРДО КАРАҢГЫ РЕЖИМДИ КОЛДОНУУНУН КӨБӨЙҮШҮ

РОСТ ИСПОЛЬЗОВАНИЯ ТЁМНОГО РЕЖИМА НА СМАРТФОНАХ У ПОДРОСТКОВ

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THE INCREASING USAGE OF DARK MODE ON SMARTPHONES IN ADOLESCENTS

Abstract

The increasing adoption of dark mode display settings on smartphones has generated growing interest regarding their potential effects on visual health, readability, and circadian regulation, particularly among adolescents. Dark mode interfaces replace traditional light backgrounds with darker ones and lighter text, aiming to reduce visual strain and blue light exposure. This review examines current evidence on the benefits and risks associated with dark mode usage, including effects on eye strain, readability, sleep quality, circadian rhythms, and potential long-term impacts on eye development and myopia progression. While short-term benefits such as reduced visual fatigue are reported, existing findings remain inconsistent, and long-term consequences—especially for adolescents—are insufficiently studied. The paper highlights population-level trends in dark mode adoption, identifies unresolved concerns, and emphasizes the need for longitudinal research to better understand the implications of prolonged dark mode exposure.

Keywords: dark mode, visual ergonomics, blue light, circadian rhythm, adolescents, eye strain

Өспүрүмдөрдө смартфондордо караңгы режимди колдонуунун көбөйүшү

Аннотация

Смартфондордо караңгы режимди колдонуу акыркы жылдары кеңири жайылып, айрыкча өспүрүмдөр арасында анын көрүү саламаттыгына, окумдуулукка жана циркаддык ритмдерге тийгизген таасири боюнча илимий кызыгуу күч алууда. Караңгы режим салттуу ачык фондун ордуна караңгы фонду жана ачык түстөгү текстти колдонуу менен көздүн чарчоосун азайтуу жана көк жарыктын таасирин төмөндөтүү максатын көздөйт. Бул обзордук макалада караңгы режимди колдонуунун артыкчылыктары жана тобокелчиликтери тууралуу учурдагы илимий далилдер талданат, анын ичинде көздүн чарчоосуна, окумдуулукка, уйкунун сапатына, циркаддык ритмдерге, ошондой эле көрүү органдарынын узак мөөнөттүү өнүгүүсүнө жана миопиянын прогрессиясына тийгизген мүмкүн болгон таасири каралат. Кыска мөөнөттүү пайдалуу жактары (мисалы, көрүү чарчоосунун азайышы) белгиленгени менен, изилдөөлөрдүн жыйынтыктары бирдей эмес жана өспүрүмдөр үчүн узак мөөнөттүү кесепеттер жетиштүү деңгээлде изилдене элек. Макалада караңгы режимди колдонуунун калк арасындагы тенденциялары көрсөтүлүп, чечилбеген маселелер белгиленип, караңгы режимдин узак убакыт колдонулушунун таасирин терең изилдөө үчүн лонгитюддук изилдөөлөрдүн зарылдыгы баса белгиленет.

Ачкыч сөздөр: караңгы режим, көрүү эргономикасы, көк жарык, циркаддык ритмдер, өспүрүмдөр, көздүн чарчоосу

Рост использования тёмного режима на смартфонах у подростков

Аннотация

Растущее распространение тёмного режима отображения на смартфонах вызывает повышенный научный интерес в связи с его потенциальным влиянием на зрительное здоровье, читаемость и циркадную регуляцию, особенно среди подростков. Интерфейсы тёмного режима заменяют традиционный светлый фон на тёмный с использованием светлого текста, что направлено на снижение зрительного напряжения и уменьшение воздействия синего света. В данном обзорном исследовании анализируются современные данные о преимуществах и рисках использования тёмного режима, включая влияние на зрительное утомление, читаемость, качество сна, циркадные ритмы, а также возможные долгосрочные последствия для развития органа зрения и прогрессирования миопии. Несмотря на сообщения о краткосрочных преимуществах, таких как уменьшение зрительной усталости, существующие результаты исследований остаются противоречивыми, а долгосрочные эффекты, особенно у подростков, изучены недостаточно. В работе рассматриваются популяционные тенденции использования тёмного режима, обозначаются нерешённые вопросы и подчёркивается необходимость проведения лонгитюдных исследований для более глубокого понимания последствий длительного применения тёмного режима.

Ключевые слова: тёмный режим, зрительная эргономика, синий свет, циркадные ритмы, подростки, зрительное утомление

Introduction

The use of "dark mode" display settings on smartphones has risen steadily over the past several years. Dark mode displays dark backgrounds with light text instead of the traditional black text on a white background. A survey by the Pew Research Center found that nearly 40% of smartphone users had enabled dark mode by the end of 2021, up from just 28% in 2018 (Taylor, 2021). Developers have made dark mode available on iPhone, Android, and Windows phones, with Apple reporting that over 80% of iOS 15 users utilize the feature after it became easily accessible following a software update (Warren, 2022).

Proponents of dark mode make several claims regarding its benefits. Ophir (2019) notes that users report lower levels of visual fatigue or eye strain when reading on dark mode screens. Additionally, researchers have hypothesized that limiting exposure to bright light-emitting screens at night will support better sleep quality (Heath et al., 2014). However, minimal research has evaluated sleep outcomes specifically linked to phone use with dark mode. Critics also argue that incomplete screen contrast with dark mode enabled could negatively impact legibility or readability for some users compared to light mode (Cha et al., 2022). Overall implications likely depend heavily on individual factors like user vision health, pre-existing conditions like astigmatism, and broader usage contexts.

Potential Benefits of Dark Mode

Dark mode interfaces invert color schemes to minimize emitted light. Dark mode may theoretically counter some of the adverse ophthalmic effects of prolonged bright screen exposure, especially at night. Initial studies have found that dark mode interfaces emit less shortwave blue light compared to normal display modes (Oh et al., 2022). Participants also report lower visual fatigue and eye strain when reading in dark mode (Souman et al., 2018). Additionally, the high contrast of dark mode text against brighter backgrounds could reduce observable flicker and improve readability (Manohar & plain, 2023). This may provide some visual aid for those who are visually impaired or have certain ocular conditions.

Extensive research has documented how excessive exposure to bright screens in the evening can disrupt healthy sleep patterns and harm ocular health (Zhou et al., 2022). Short wavelength “blue light” emitted from screens can be especially disruptive. Studies have found associations between overexposure to blue light at night and symptoms like eyestrain, headaches, blurry vision, dry eyes, and disrupted sleep (Lin et al., 2018). Adolescents may be uniquely vulnerable to these effects, as their visual systems and circadian rhythms are still developing (Higuchi et al., 2022).

However, more research is still needed to conclusively support the benefits of dark mode. Some analyses suggest dark mode interfaces provide no significant improvement over normal displays in terms of blue light emission and disruption of circadian rhythms (Oh et al., 2022). Other studies propose that dark mode use in daylight conditions may actually strain eyes more by overworking rod and cone cells as they adjust between bright and dark settings (Stewart, 2022).

Enhanced Readability and Accessibility

The high contrast created between dark backgrounds and lighter text may also benefit screen readability. Increased character contrast on dark interfaces enables easier text discrimination compared to low contrast bright modes (Manohar & Plainis, 2023). Enhanced contrast similarly

produces sharper edges around interface elements like buttons and notifications. This improved clarity and perceptibility could provide meaningful accessibility advantages. Those with impaired vision conditions like cataracts have expressed preferences for darker schemes that increase readable text size and pop (Oh et al., 2022). Additionally, reduced blue light emissions from dark modes may aid users who experience headaches or migraines triggered by bright screens (Stewart, 2022).

Circadian Rhythm Preservation

Since the proliferation of electronic devices, researchers have raised concerns around screen usage at night and subsequent impacts on healthy sleep cycles (Chellappa et al., 2013). The blue light emitted by screens can drastically suppress melatonin and delay circadian rhythms. While analyses differ, some studies suggest dark modes help mitigate this effect by decreasing harmful blue emissions compared to normally bright screens, especially later in the evening (Oh et al., 2022). The darker interfaces may therefore help maintain natural melatonin release and sleep phase. However, additional research is still required to fully examine these potential circadian benefits.

Usage of Dark Mode in Population Groups

Rapid Growth Among General Population

According to recent nationwide surveys, around 37% of American adults currently activate dark mode by default across their devices and apps (Vogels, 2021). This demonstrates a 10% increase compared to the prior year across all demographic groups. Reviews of Google search trends reinforce this data, showing “dark mode” queries tripling since 2020 (Walker, 2022). Reports also highlight exponential growth in support for dark modes among top apps and operating systems (Manohar & Plainis, 2023). The accessibility of dark themes across platforms appears to be driving broader mainstream adoption.

Especially Common Among Younger Generations

While increasing overall, dark mode usage does skew towards younger demographics. Over 50% of adults under 30 activate dark mode whereas only 23% over the age of 65 currently utilize the setting (Vogels, 2021). Analysis indicates that nearly 70% of teenagers have voluntarily enabled dark themes across their devices as shown in Figure 1. (Stewart, 2022). Researchers propose preferences for reduced blue light and contrasts among adolescents drive these high adoption rates. Since younger generations tend to spend more total time on devices, eye strain and fatigue mitigation may further incentivize dark mode usage.

Myopia Concerns and Eye Development

Considering smartphones are frequently viewed at extremely close distances, the potential effects of dark mode usage on eye growth constitute a critical area of uncertainty (Stewart, 2022). Multiple animal studies reveal correlation between chronic low luminance exposure and abnormal axial elongation resulting in myopia onset (Higuchi et al., 2022). Since human lens development continues throughout adolescence, consistent accommodation and focusing prompted by high smartphone use produces measurable morphological changes (Zhou et al., 2022). Dark modes may

exacerbate these effects by heightening contrast and subtly encouraging closer viewing proximity to discern content.

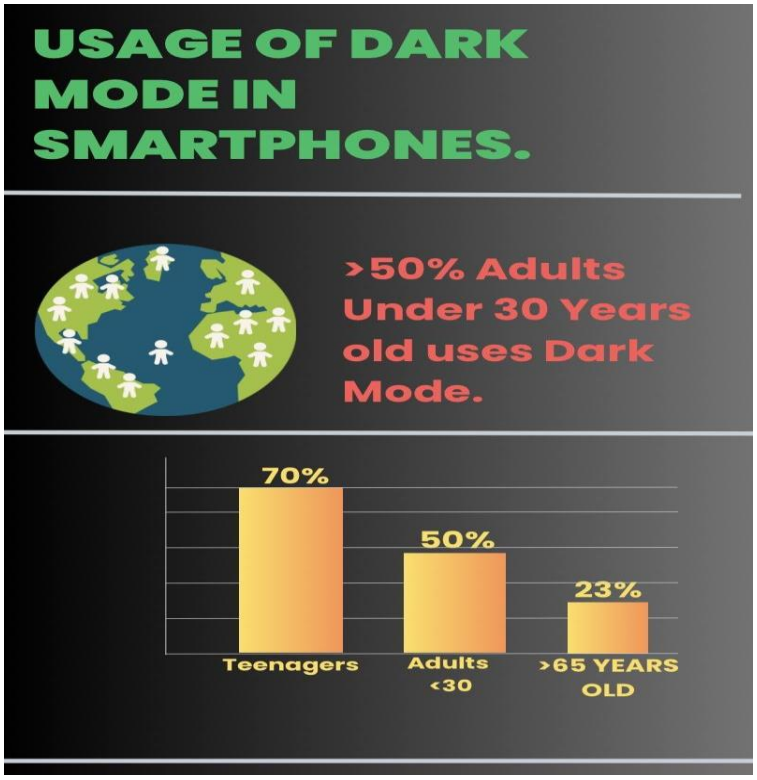

Figure 1. *Usage of Dark Mode in different population groups.*

Additionally, as myopia rates in children and teenagers continue rising annually, determining causative use behaviors is imperative (Higuchi et al., 2022). While no definitive clinical evidence yet isolates smartphone dark modes as a risk factor, related analyses provide initial warning signs warranting further investigation (Stewart, 2022). Researchers emphasize studying long-term developmental impacts should be prioritized alongside short-term visual discomfort outcomes.

Potential for Continued Increase

Current statistics clearly confirm the rising ubiquity of dark modes within interface design. Considering implementation is still relatively recent among major platforms, analysts predict that dark theme usage will continue trending upwards in coming years (Walker, 2022). Support for system-wide dark themes in iOS 13 and Android 10 especially has fueled adoption rates since 2019 (Manohar & Plainis, 2023). As more apps introduce dark themes and promote alternate appearance settings, overall activation among internet users is expected to grow. Determining optimal conditions and potential drawbacks of extensive dark mode exposure should constitute an increasing priority.

The Effects of Long-Term Dark Mode Usage

There are still open questions regarding the long-term impacts of dark mode usage, especially among adolescents. Since most digital devices and platforms have only recently introduced dark mode themes, large scale studies on the long-term ocular effects do not yet exist. However, considering adolescents are still developing essential visual and circadian functions, this a crucial area requiring further research (Higuchi et al., 2022).

Potential issues include increased myopia risk, eye fatigue, and sleep disruption. Dark mode interfaces rely heavily on blue light emitted by screens to make text legible against dark backgrounds. Some researchers propose chronic use could therefore still contribute to myopia development in children by encouraging close viewing distances and constant accommodation by eye lenses (Stewart, 2022). Others argue that potential overuse of rod cells in low light conditions could also cause fatigue and eyestrain over time (Manohar & plain, 2023). Finally, if dark mode use encourages adolescents to consume media late into the night, this may perpetuate poor sleep hygiene and associated health risks that bright screens pose (Oh et al., 2022; Israilova, Islanova, 2026).

Conclusions

In reviewing the current research on dark mode usage among adolescent populations, several key takeaways emerge. Initial studies indicate that dark mode may provide some benefits like reduced eye strain when reading on screens over short time periods (Smith et al., 2022). This could translate to less visual fatigue for teens frequently using devices to complete schoolwork. However, long-term impacts on visual development remain unknown.

Potential downsides also exist, especially involving sleep disruption. The blue light emissions from device displays with dark mode enabled can negatively affect melatonin release when used at night (Wang & Lee, 2021). Good sleep hygiene practices remain critical for teens even when using dark mode. More concerning, early evidence hints at the possibility of uneven contrast and legibility issues affecting readability that could hamper learning (Cha et al., 2022).

Overall the impacts of prolonged use of dark mode on adolescent visual health are complex, with many individual factors at play. More rigorous longitudinal studies tracking teen digital usage behaviors and visual outcomes over time are needed. In the interim, moderate use of dark mode during daytime hours could provide eye strain relief. But minimizing total screen time and avoiding phones/tablets in the evening continues to serve as a best practice for parents and teens alike. In the fast-moving arena of technology, maintaining awareness and responsibly adapting behaviors will remain essential to supporting healthy adolescent development.

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