King Fahd University of Petroleum & Minerals

Human-Computer Interaction (SWE-503-01)

Assignment: Phase #2 Literature Review

Does Dark Mode Prolong Focus Span (and Performance) During Process Work (e.g., Performance Reviews)?

Name: Nawaf AlOwain

Student ID: G202421900

Introduction

Process work in **HR systems**—such as organizing a set of employee **Performance Evaluations**—requires sustained attention across repetitive, detail-oriented screens (**ratings, comments, calibration notes**). Over long periods, visual theming (**dark vs. light**) may influence workload, accuracy, and time-on-task. While newer HCI work on dashboards and visualization indicates mixed, task and user-dependent results, classic visual-ergonomics research often reports a positive-polarity advantage (**black text on light background**) for small-text precision and proofreading capabilities. Crucially, most studies are brief and do not specifically assess attention span during lengthy, frequently interrupted sessions that are typical of HR review cycles.

Proxy Paper

A within-subjects eye-tracking study on dashboard decision-making with dark versus light themes and different task complexity was conducted **by Ettling, Steinmann, Bektaş, and Abbad-Andaloussi (2025**). Completion time, accuracy, confidence, fixation counts, pupil dilation, and NASA-TLX workload were among the metrics. Although there is no overall dominance, the results show situational benefits for dark mode (**e.g., reduced workload, fewer fixations, sometimes improved accuracy at medium complexity**). This serves as an effective measurement template and emphasizes the necessity of testing longer sessions and realistic workflows as a stand-in for HR dashboards (**ratings summaries, drilldowns, infographics**).

Theme 1 — Visual Performance (speed/accuracy) on Text-Heavy Tasks

According to foundational polarity studies, light mode improves reading and verification ability, particularly for dense text and small fonts. This is explained by the fact that a higher display brightness results in narrower pupils and a sharper retinal picture. This research forecast's light theme advantages in micro-accuracy and scan speed for HR review forms containing fine text (**policy notes, competency definitions, lengthy comments**). These findings, nevertheless, are based on reading and proofreading exercises and might not translate exactly to mixed user interface screens.

Theme 2 — Workload, Attention & Prospects for Focus Span in Dashboards

Where tasks involve summarizing charts/tables (**calibration views, bell curves, KPI tiles**), contrast polarity effects are heterogeneous. There was no single best mode in a visualization study with 134 participants; instead, the better-performing polarity differed by person and average differences were small, supporting the idea of providing both modes. However, at some complexity levels, the proxy paper displays fewer fixations in dark mode and a reduced workload, which are indicators of a possibly slower rate of performance degradation as sessions get longer (**albeit the trials were brief**). All of data indicates that dark mode may be useful in certain dashboard situations, but not always, and that the benefits of prolonged use are still unproven.

Theme 3 — Comfort/Fatigue as Mediators (Ambient Light Matters)

Studies isolating fatigue (**rather than performance**) show context-dependent effects. Dark mode on smartphones decreased self-reported eye fatigue in bright ambient light, but it had no effect on dim light. A study on tablets discovered that both modes gradually increased fatigue, with dark mode occasionally lowering the risk of dry eyes. Although they are not performance assessments, reduced effort and weariness may help maintain concentration during lengthy HR review batches, particularly when using high-bright laptops or under bright office lighting.

Theme 4 — Moderators: User Traits, Typography/Contrast, and Policy Screens

Guidelines and reviews caution that for users with normal or enhanced vision, light mode often yields better visual performance; dark mode may benefit glare-sensitive users, certain low-light contexts, or OLED devices (**reduced glare/halation**). Numerous inconsistencies can be attributed to methodological decisions about font size/weight, line-height, and WCAG contrast. HR review user interfaces frequently blend visual summaries (ratings distributions) with fine text (**policy/legal**). It is therefore more reasonable to utilize context-aware theming (or user-selectable theming) with carefully adjusted font size/contrast rather than assuming a universal dark-mode speed improvement, as a single global theme may not be ideal.

Gap & How Your Study Contributes

Most dark vs. light studies: (a) use **short trials** (minutes, not 45–90 minutes),

(b) focus on **reading or simple chart tasks** instead of **full process flows** (search → read → rate → comment → calibrate),

and (c) rarely model **interruptions** or **attention lapses** that occur in HR cycles. Empirical evidence directly answering, **"Does dark mode *prolong focus span* during process work?"** is **scarce**.

Your study (building on Ettling et al.) should:

1. **Within-subjects** comparison of dark vs. light themes on a **Performance-Review workflow** (multi-employee batch).
2. **Extended sessions** (≥60 min) to capture **focus span** and **performance-over-time** (time/employee, micro-errors, backtracks).
3. **Objective attention metrics** (eye-tracking: fixation count/length, blink rate; optional keystroke pauses) + **NASA-TLX** each block.
4. **Ambient-light manipulation** (bright office vs. dim) and **typography/contrast** controls (WCAG-compliant variants).
5. **User traits** (vision, age, habitual theme preference) to analyze **moderation**.

Hypothesis (patterned on the literature): Dark mode will **not** uniformly increase performance. It may **lower workload** and **slow performance decay**—thus **prolonging effective focus span**—for **some users** and **lighting/device** conditions (e.g., bright environments with high-glare displays), while **light mode** remains superior for **fine-print, precision text** portions of the flow.

References (APA-style)

Buchner, A., & Baumgartner, N. (2007). Text–background polarity affects performance irrespective of ambient illumination and colour contrast. *Ergonomics, 50*(7), 1036–1063. floppybunny.org

Buchner, A., Mayr, S., & Brandt, M. (2009). The advantage of positive text-background polarity is due to high display luminance. *Ergonomics, 52*(7), 882–886. psychologie.hhu.de+1

Ettling, T. J., Steinmann, D., Bektaş, K., & Abbad-Andaloussi, A. (2025). *An eye-tracking study on the effects of dark and light themes on user performance and workload* (ETRA '25). ACM. https://doi.org/10.1145/3715669.3725879 ACM Digital Library

Pathari, F. J., et al. (2024). Dark vs. light mode on smartphones: Effects on eye fatigue. *ACHI 2024*. (PDF). thinkmind.org+1

Sengsoon, P., et al. (2025). Immediate effects of light mode and dark mode features on visual fatigue in tablet users. *Healthcare*. (PMC). PMC+1

While, Z., & Sarvghad, A. (2024). Dark mode or light mode? Exploring the impact of contrast polarity on visualization performance between age groups. *arXiv preprint*. arXiv+1

Nielsen Norman Group. (2023). *Dark Mode: How Users Think About It and Issues to Avoid*; (n.d.) *Dark Mode vs. Light Mode: Which Is Better?* Nielsen Norman Group+1

Lin, P.-H., et al. (2024). Effects of color and ambient illumination on legibility and performance. *Displays*. ScienceDirect

Fan, Q., et al. (2024). The effect of ambient illumination and text color on visual performance and fatigue. *Sensors*. MDPI