# Daylight with Blue or Red Lights Affect Performance and Sleepiness at Night

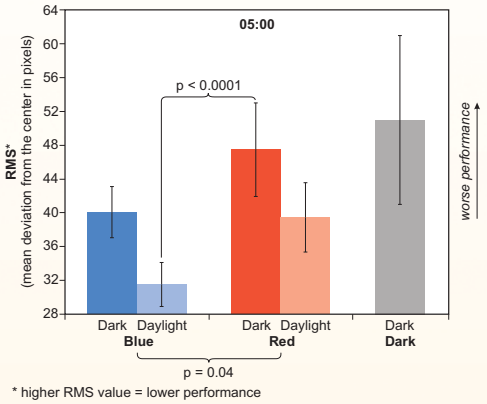
Daylight is considered a desirable source of illumination in buildings, and daytime light exposure has been shown to activate brain regions associated with alertness. LRC researchers examined the interactive effects of daylight and narrow-band (red and blue) light on performance, and subjective sleepiness over the course of 26 hours without sleep.

## Experiment

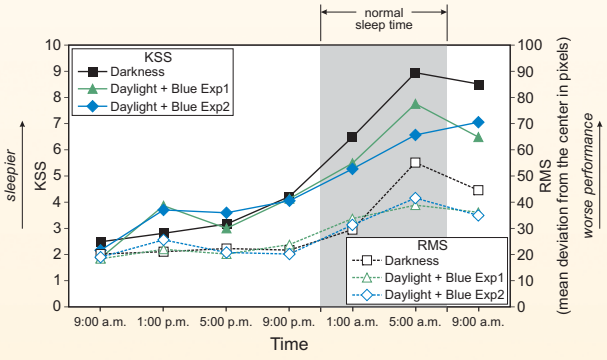
Thirteen subjects participated in a four-session, within-subjects study. Each 26-hour session was separated by at least one week, and began at 07:00 and concluded at 09:00 the following day. The four experimental conditions were daylight or darkness (< 1 lux of red light at the eye) interspersed every four hours with 40 lux of 640-nm (red), or with 470-nm (blue) light for one hour starting at 08:00. Eight of the subjects agreed to participate in a fifth session, where they again remained in continuous darkness for 26 hours without sleep. Subjects were seated at desks facing a window, either open to daylight or covered with opaque black-out shades. During the red-light or blue-light exposure periods, performance was measured on the Multi-Attribute Task (MAT) battery for Human Operator Workload and Strategic Behavior Research software program. The root mean square (RMS), which is the deviation from the center in a tracking task, was used as a measure of performance. At the end of the 54-minute test, subjects were asked to fill out a Karolinska Sleepiness Scale (KSS) to assess their subjective sleepiness.

## Results

- Blue light in combination with daylight had the greatest positive impact on nighttime performance at 5:00 a.m., while red light in combination with daytime darkness had the least positive impact.
- Daylight had a small, but not statistically significant, effect on performance at night.




* higher RMS value = lower performance




- Light does not have a major impact on performance or self-reports of sleepiness during the day, but does affect them both at night.
- The results of both performance and self-reports of sleepiness were well replicated in two experiments.

## Sponsors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