Plan Overview

A Data Management Plan created using DMPonline

Title: Exploring the Psychological, Emotional and Behavioural Effects of Artificial Lighting

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Project abstract:

This study aims to investigate how blue light exposure affects emotions, psychic health, and behaviours, constituting one of several studies within the overall project aimed at expanding the knowledge base and uncovering underlying mechanisms. Specifically, it seeks to determine whether blue-light emitting diodes (B-LED) lamps have a calming effect or influence psychological responses through other pathways. The insights gained will help to inform the potential application of B-LED lighting in various settings.

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Exploring the Psychological, Emotional and Behavioural Effects of Artificial Lighting

Description of data

How will data be collected, created or reused?

The study will take place at the Department of Psychology, in the Sleep Laboratories at Stockholm University (Albano Campus). The entire duration required for each participant will be a single 60-minute session with no follow-up appointments necessary.

First, written informed consent will be obtained from all individuals who volunteer to participate in the study by researchers trained in this process. This includes providing an information sheet containing details about the study's purpose, what participation involves, potential risks, the type of data to be collected and how it will be stored, compensation, their rights as a participant, as well as contact information for the principal investigator (huvudansvarig forskare). During this time participants will also be given an opportunity to ask questions before proceeding. Those that consent to partake will first undergo baseline assessments. This begins with measuring the resting heart rate of participants using an electrocardiogram (ECG). Participants will place the electrodes on themselves under the guidance of the study coordinator. The electrodes will remain in place throughout most of the data collection process to provide continuous monitoring. Baseline questionnaires will then collect demographic and lifestyle information, as well as measure participants' current emotional state and stress level. Next, maximum hand grip strength will be measured using the participant's dominant hand to determine the endurance setting (30% of their maximum grip strength) for the behavioural perseverance task. This ensures that the endurance task is equally challenging for all participants. Lastly, a baseline test will be conducted to assess participants' initial proficiency in the N-back task before proceeding with the main experimental phase.

During the next phase, participants will be allocated to either the intervention or control group using block randomisation. The study coordinator will select a pre-randomized card from a set of 24 (all possible randomized orders) which states the condition, task order, and lighting exposure order the participant will receive – up until this point the study coordinator will be blind to such information. Three tasks will be completed to measure behavioural perseverance (BP) with the order of tasks varying for each participant through Latin square randomisation. The hand grip endurance task will be carried out as follows: Using their pre-determined endurance setting, participants will be instructed to clench the hand grip device and hold that strength for as long as possible or until they decide to give up. If the participant sustains their grip for five minutes, the study coordinator will end the task. Perseverance is measured by how long the participant maintains their grip. The N-back task will be carried out as follows: The initial baseline assessment will have determined the appropriate starting level of difficulty to ensure that each participant faces an equal challenge. Participants will be instructed to complete the task on a computer and continue until they either choose to quit or reach a predetermined duration (five minutes). Perseverance is measured by how long the participant persists through the task. The thread and needle task will be carried out as follows: Participants will be instructed to simply thread a needle. They will not be informed beforehand that the task is intentionally designed to be frustrating. The width of the thread will make it impossible to complete, especially within the given time limit and under the rules, which state that participants cannot use their mouth or the other hand and must only hold the thread beyond a knot located approximately 5 cm from the tip. Participants will be asked to carry out the task until they decide to give up or until the study coordinator ends the task (if they reach 5 minutes). The level of performance will be assessed by how long participants persist in trying to thread the needle. After each task, participants will complete a single-item stress scale and a single-item effort scale. Participants will continue under either the intervention or control lighting condition and then fill out a brief questionnaire assessing their current

emotional state, depression, anxiety, stress, suicidal ideation, as well as a hope scale. The study coordinator will then change the lighting back to the normal room lighting condition (ending the experimental lighting exposure).

The post-experimental phase comprises two final components. First, the participant will complete the single-item stress scale one last time, before removing the electrodes from themselves, and then complete another questionnaire measuring psychological symptoms and transportation habits. Lastly, associations to both lighting conditions will be assessed for all participants through free recall of up to five words associated with each condition, along with an estimation of the perceived strength of the association in relation to the light. The order of exposure to the lighting conditions will be randomised using block randomisation, alternating between blue-first and white-first for each participant

What types of data will be created and/or collected, in terms of data format? Include version numbers if applicable.

Data will be collected in a laboratory experiment using three behavioural tasks, electrocardiogram (ECG) and self reported questions collected by a digital survey. The data will comprise a data matrix including all participants, in which self-report answers and aggregated information from the behavioural tasks (n-back, hand grip, thread and needle tasks) are stored. A separate data file will contain time series of the participants' ECG recordings, including heart rate time series and heart rate variability measurements. Another file will contain the participants responses for each trial in the n-back task. The data will be reproducible based on the study protocol that will be published openly.

All three data file will be openly accessible when the results have been published in peer review journals. The files will be in non-proprietary formats (.csv, .Rdata)

What volumes of data will be created and/or collected?

- < 1 TB

Data will be less than 100 GB but the Bayesian model fit files may togeather exceed 100 GB. As of 2026-06-24 this is unknown.

Documentation and data quality

How will the material be documented and described, with associated metadata relating to structure, standards and format for descriptions of the content, collection method, file naming-format-versioning, etc

The material will be documented with metadata containing the code book for the survey questions and descriptions of the data from the behavioural perseverance tasks (n-back, hand grip, thread and needle). The collection procedure will be published openly when the data collection starts, providing the information needed to understand the data collection background that generated the data. The files will be named in the formats stated below.The folder structure will follow the Psych-DS format guide (i.e. analysis/data).

The file containing the self-report and aggregated behavioural data for all participants will be named:

1) "BLISP_survey_[date saved]_data.csv",

The participant specific HR file will be named:

2) "HR_measurments_[participant id]_[date saved]_data.csv"

The participant specific N-back file will be named:

3) "N-back_[measurment type]_[participant id]_[seconds for endurance task*]_[7 digit random_number]_[date saved]_data.csv".

* Only for endurance task

How will data quality be safeguarded and documented (for example repeated measurements, validation of data input, etc.)?

Data will be checked during and post collection for data entry errors, out of bounds values and missing data. A description of changes due to the results of the checks will be documented and published openly.

Storage and backup

How is storage and backup of data and metadata safeguarded during the research process?

- KI OwnCloud

All data will be temporarely stored on a research group one-drive folder until data checks has been completed. The folder structure will follow the Psych-DS protocol (analysis/data). When data checks have been conducted, the data will be uploaded to the Karolinska Institutet Electronic Lab Notebook (KI ELN) system. This data material will then be a full set of N-back and HR individual data files from the participants thus far and a partial data set from the survey only covering the part of the full sample material.

Data on both One-drive and KI ELN is continously backed up by KI centrally.

How is data security and controlled access to data safeguarded, in relation to the handling of sensitive data and personal data, for example?

The data collected in the experiment is anonymous, thus there is no need for protection of personal information. However, regardless both data storage areas (One-drive & KI ELN) are protected by two-factor authentication (2FA). Thus only available to authorized employees in the research group and the KI system administrators. All nework traffic from ELN is encrypted and audit trails are used to track data changes and user activity. In OneDrive changed and deleted datasets can also be recovered.

The data saved on (One-drive & KI ELN) is backed up centrally with two redundant servers for standardized physical security.

Legal and ethical aspects

How is data handling according to legal requirements safeguarded, e.g. in terms of handling of personal data, confidentiality and intellectual property rights?

No personal data is handled in the project. Data is handled confidentially so that no individual participants data can be linked to them personally. There are no intellectual property rights to consider in the project.
The renting of the lab at Stockholm University is handled by a separate contract, and there is no agreement on collaboration with regard of analysis or publications outside the renting of the space.

How is correct data handling according to ethical aspects safeguarded?

The project does not collect personal data, thus data is always anonymized. All participants need to provide written informed consent that is stored on paper and without codes that can connect it to the data. Ethical approval has been granted by the Swedish Ethical Review Authority (reference number: 2025-00418-01).

Accessibility and long-term storage

How, when and where will research data or information about data (metadata) be made accessible? Are there any conditions, embargoes, licenses and limitations on the access to and reuse of data?

After publication the data will be openly available through the Swedish National Data Service (https://snd.se/en). After the project journal publications are finished, the open accessible data can be used, as long as the project journal publications are referenced.

In what way is long-term storage safeguarded, and by whom? How will the selection of data for long-term storage be made?

After publication at the Swedish National Data Service (https://snd.se/en) the data will get a DOI and be freely available long-term.

Will specific systems, software, code or other types of services be necessary in order to open and use/analyse data in the long term?

Data will be stored as .csv and .Rdata files and thus usable as is for the foreseeable future. If new standard data formats are developed in the future, it should be easy to transform the project data files into those by open source software such as R or Python.

How will unique and persistent identifiers for the research data, such as a Digital Object Identifier (DOI), be obtained?

The Swedish National Data Storage (https://snd.se/en) will provide a DOI when the data is published.

Responsibility and resources

Who is responsible for data management while the research project is in progress?

Data management is performed by a dedicated data manager in the research group, who is an experienced researcher with a PhD.

Who is responsible for data management, long-term storage after the research project has ended?

The PI is responsible for data management generally and long-term storage will be provided by the Swedish National Data Service.

What resources (costs, labour or other) will be required for data management (including storage, back-up, provision of access and processing for long-term storage)?

No specific resources are needed for data managment and storage. They are part of the work description of the data manager and storage costs are covered by Karolinska Institutet centrally.

What resources will be needed to ensure that data fulfil the FAIR principles?

The data material will be *findable* by the open access publication through the Swedish National Data Service. This will comprise a thourough meta data description that provides the information needed to understand and use the data material.

The data will be *accessible* by the use of a persistent identifier (DOI) through the Swedish National Data Service.

The data will be *interoperable* by using standardised measures, clear descriptions, and openly available analysis scripts.

The data will be *resusable* through a high quality data collection, checks, analysis and documentation.It will allow for checks of the project analysis, replication or meta analytical aggregation.