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Investigating occupational health via personal lighting conditions

Citation for published version (APA):
van Duijnhoven, J., Aarts, M. P. J., Rosemann, A. L. P., & Kort, H. S. M. (2017). *Investigating occupational health via personal lighting conditions*. Poster session presented at ILIAD 2017, Eindhoven, Netherlands.

Document status and date:
Published: 14/11/2017

Document Version:
Publisher's PDF, also known as Version of Record (includes final page, issue and volume numbers)

Please check the document version of this publication:

• A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
• The final author version and the galley proof are versions of the publication after peer review.
• The final published version features the final layout of the paper including the volume, issue and page numbers.

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Download date: 17. Nov. 2023

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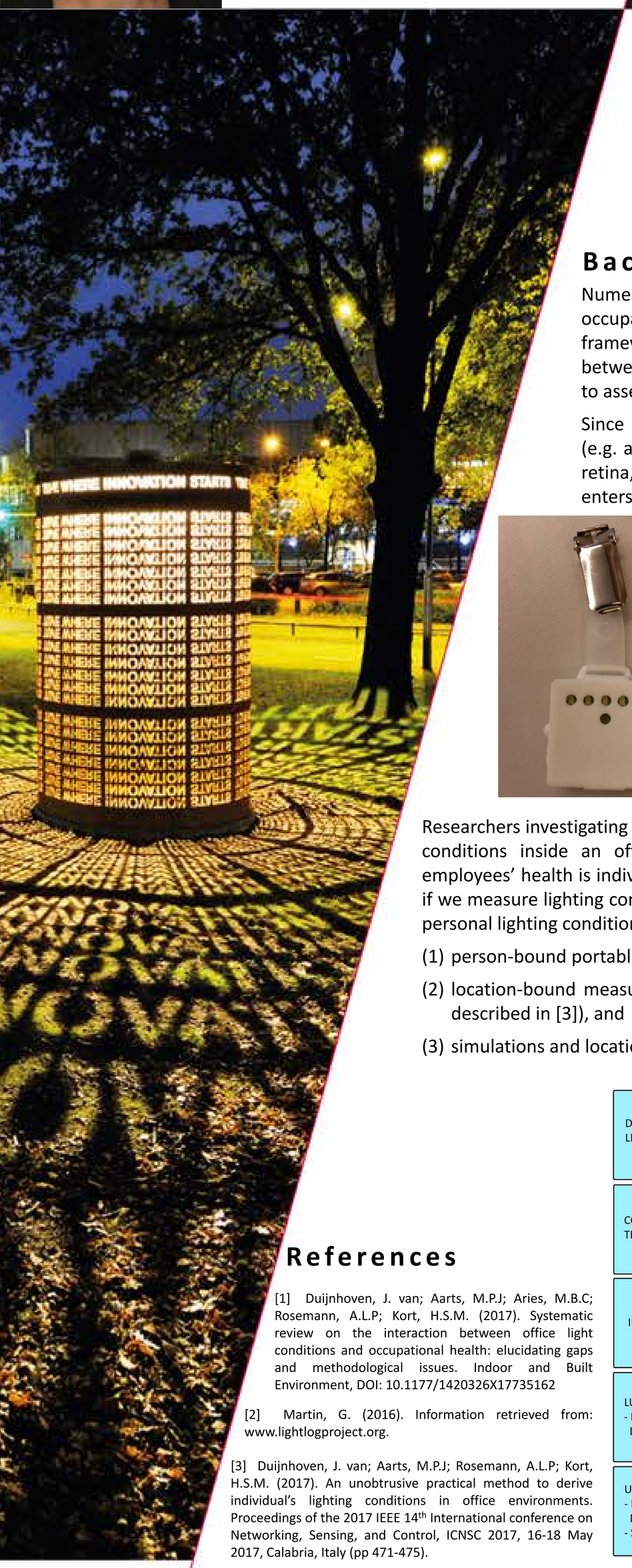


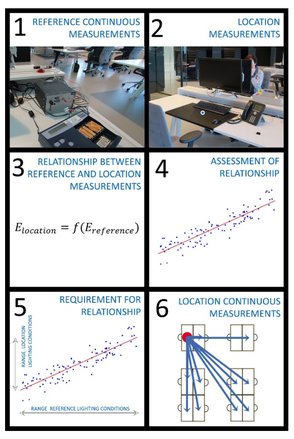
Investigating occupational health via personal lighting conditions

Background

Numerous studies investigated the effect of office lighting on occupational health. Based on a literature study [1], a theoretical framework was proposed demonstrating the indicated correlations between an office lighting parameter and a health indicator used to assess occupational health (see Figure 1).

Since it is known that light effects our non-image-forming system (e.g. alertness) when light is being captured by the ipRGcs on the retina, it is essential to know how much and what type of light enters the eyes.

← Figure 2: A wearable light measurement device (LightLog) developed by Martin [2].



→ Figure 3: The six-step process of the practical non-obtrusive method to derive individual's lighting conditions throughout an entire office building developed by Van Duijnhoven et al. [3].

Researchers investigating the health effects of office lighting often use average lighting conditions inside an office environment for the effect analyses. However, the employees' health is individual and we expect that we can *support* their health better if we measure lighting conditions individually. There are multiple methods to measure personal lighting conditions, for example via:

(1) person-bound portable measurement devices (Lightlogs [2], see Figure 2),

(2) location-bound measurements (according to the non-obtrusive practical method described in [3]), and

(3) simulations and location-tracking.

Methodology

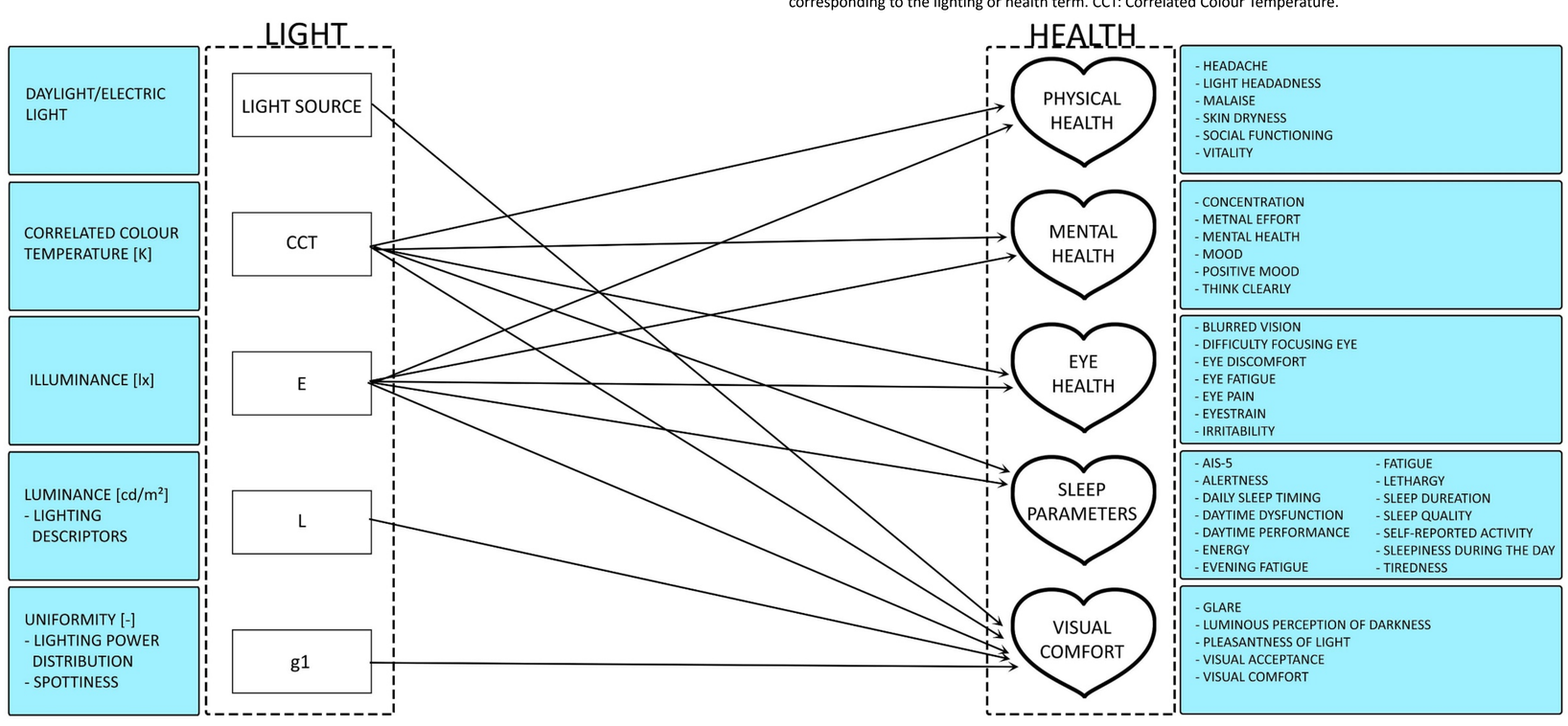
In May 2017, the person-bound (1) and location-bound (2) method were applied in order to compare these different measurement methodologies. The person-bound wearables were worn by 69 office workers whereas the location-bound measurements were performed for two weeks with a sample period of 10 seconds in the first week and 1 minute in the second week. The location-bound measurements were performed at five reference locations throughout the office building.

In addition to these lighting measurements, questionnaires regarding health and satisfaction were distributed four times a day. The questionnaires consisted of the general health questionnaire SF-36, the sleepiness questionnaire KSS, the office lighting survey OLS, and questions to gather additional information concerning occupational health.

Further steps

The two methodologies to measure light (i.e. vertical illuminances at eye height behind a desk) will be compared by calculating the deviations between those methods. Potential explicatory variables will be included in the analysis in order to explain the magnitude (and direction) of the deviations.

The subjective data (1519 questionnaires) combined with personal lighting conditions may give new insight in the link between office lighting and occupational health.



↓ Figure 1: Overview based on all conclusions drawn in the systematic review of Van Duijnhoven et al. [2]. The heart shaped terms are occupational health-related aspects and the terms in rectangles are office lighting parameters. All arrows indicate expected interactions. The outer boxes provide additional information corresponding to the lighting or health term. CCT: Correlated Colour Temperature.

References

[1] Duijnhoven, J. van; Aarts, M.P.J; Aries, M.B.C; Rosemann, A.L.P; Kort, H.S.M. (2017). Systematic review on the interaction between office light conditions and occupational health: elucidating gaps and methodological issues. Indoor and Built Environment, DOI: 10.1177/1420326X17735162

[2] Martin, G. (2016). Information retrieved from: www.lightlogproject.org.

[3] Duijnhoven, J. van; Aarts, M.P.J; Rosemann, A.L.P; Kort, H.S.M. (2017). An unobtrusive practical method to derive individual's lighting conditions in office environments. Proceedings of the 2017 IEEE 14th International conference on Networking, Sensing, and Control, ICNSC 2017, 16-18 May 2017, Calabria, Italy (pp 471-475).

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