The effect of lighting colour and intensity on thermal comfort, physiology & alertness

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The objective of the proposed experiments is to study the effect of lighting intensity and spectral composition (correlated colour temperature) on thermal comfort and thermo physiology. The obtained insights can be used to improve thermal comfort,...

Ethical review	Approved WMO
Status	Recruitment stopped
Health condition type	Other condition
Study type	Interventional

Summary

ID

NL-OMON44432

Source
ToetsingOnline

Brief title
Light, thermal comfort, physiology & alertness

Condition

- Other condition

Synonym
nvt

Health condition

verkrijgen van inzicht in de interactie tussen licht, thermisch comfort, fysiologische respons en alertheid van mensen

Research involving
Human

Sponsors and support

Primary sponsor: Universiteit Maastricht
Source(s) of monetary or material Support: Partnership program STW- Philips Electronics: Advanced Sustainable Lighting Solutions (ASLS) Technologiestichting STW;onderdeel van de Nederlandse Organisatie voor Wetenschappelijk Onderzoek (NWO) en wordt deels gefinancierd wordt door het Ministerie van Economische Zaken

Intervention

Keyword: Alertness, Light, Thermal comfort, Thermoregulation

Outcome measures

Primary outcome

Experiment 1

The primary objective of the first experiment is to obtain insight in the

effect of the lighting intensity (experiment 1a) and the spectral composition

of lighting (experiment 1b) on thermal comfort and sensation, whole body energy

expenditure and alertness. This effect will be tested under thermo neutral,

mild cold and mild warm conditions.

Experiment 2

The primary objective of the second experiment is to obtain insight in the

effect of the lighting intensity and the spectral composition of lighting on

thermal comfort and sensation, whole body energy expenditure and alertness in

an office set up.

Secondary outcome

Experiment 1:

The secondary objective of the first experiment is to study the effects of

lighting intensity (experiment 1a) and colour temperature (experiment 1b) on

visual comfort, thermo physiology (skin- and core temperature and blood perfusion) and cardiovascular parameters under different thermal conditions.

Experiment 2:

The secondary objective of the second experiment is to study whether the effects of dynamic LED lighting on visual comfort, thermo physiology (skin- and core temperature and blood perfusion) and cardiovascular parameters, are also applicable in a laboratory controlled office setting. Because the effects of LED lighting in office setting may depend on the time of the day the effect of light intensity will separately be tested under more standardized conditions during the morning and evening.

Study description

Background summary

The built environment consumes much energy for heating and cooling of buildings to maintain indoor temperatures within the narrow limits prescribed by standards. However, thermal comfort and thermo-physiology are not only influenced by ambient temperature, also by many individual factors such as (thermal) behaviour, psychological and physiological characteristics of a building occupant. The colour and intensity of light may also play a role in this respect and could have the potential to improve thermal comfort and alertness of building occupants using different illuminance levels and the spectral tuning of light. Additionally this may result in a reduction of the energy consumption of buildings.

Study objective

The objective of the proposed experiments is to study the effect of lighting intensity and spectral composition (correlated colour temperature) on thermal comfort and thermo physiology. The obtained insights can be used to improve thermal comfort, thermo physiology and alertness of building occupants by means of dynamic lighting systems that consume little energy and have a broad range

of possible intensities and spectral compositions.

Study design

All experiments of this study are carried out in the "*Metabolic Research Unit Maastricht* (MRUM) of the department Humane Biologie, Maastricht University.

The first experiment (1a) consists of two sessions. In one of the sessions,measurements will be carried out under dim light (5lux) and mild warm, mild cold and thermo neutral temperature. During the other session the same protocol will be carried out, however this time under bright light (1200lux).

The next experiment (1b) is the same as 1a, only this time the measurements are performed under a low colour temperature (2700K) compared to a high colour temperature (6500K) of light.

During the second experiment, the results of experiment 1 will be tested in an artificial office environment. The effect of light will be tested in the morning and in the evening. The first part (experiment 2a) consists of 3 sessions in the morning. The experiments will be done in a warm environment under different light conditions: baseline (50 lux en 2000K), light condition A (750 lux en 6500K) and light conditionB (50 lux en 6500K). The results of the first experiment are used to design these lighting conditions. During the experiments physiological measurements and productivity tasks will be done. In experiment 2b, the physiological effect of light intensity in the morning (1 session) and evening (3 sessions) will be tested. This experiment will be performed under more standardised conditions (compared to 2a) because skin blood flow is the primary outcome.

During each experiment the different sessions are randomised.

Intervention

Experiment 1a:
Exposure to a low light intensity (5 lux) and a high lighting intensity (1200 lux), under mild cold, neutral and mild warm temperatures.

Experiment 1b:
Exposure to a low colour temperature (2700K) and a high colour temperature (6500K), under mild cold, neutral and mild warm temperatures.

Experiment 2a:
Exposure to a warm temperature (around 29*C) and different lighting conditions. Light may vary in colour temperature (2000K-6500K) and intensity (5lux - 750 lux).

Experiment 2b:
Exposure to a neutral temperature (around 29*C) and different lighting conditions. Light may vary in intensity (5lux - 1300 lux).

Study burden and risks

The radiation dose for the DXA-scan is comparable to the radiation with an X-ray in the dental clinic. Illuminance levels will be kept within normal range. No ocular safety issues are foreseen. Further than possible discomfort due to exposure to a mild cold and mild warm environment, no significant burden or risk for the subjects is expected.

Contacts

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Trial sites

Listed location countries

Netherlands

Eligibility criteria

Age
Adults (18-64 years)
Elderly (65 years and older)

Inclusion criteria

• Caucasian volunteers
• Generally healthy
• Age: 18 to 30 years
• BMI: 18-25 kg/m2
• Using Microgynon 30 or levonorgestrel/ehinylestradiol
• Normal chronotype

Exclusion criteria

• Colour blindness
• Ocular pathologies
• Medication use
• Pregnancy
• Hypertension (systolic/diastolic blood pressure >140/90)
• Hypotension (systolic/diastolic blood pressure <90/60)
• General feeling of illness at day of experiment
• (History of) cardiovascular diseases
• Contraindications of the telemetric pill:
o In the presence of any known or suspected obstructive disease of the gastrointestinal tract, including but not limited to diverticulitis and inflammatory bowel disease
o A history of disorders or impairment of the gag reflex
o Previous gastrointestinal surgery
o Hypo motility disorders of the gastrointestinal tract including but not limited to Illeus
• Participants that do not want to be informed about accidental medical findings, which might occur during the study. If participants do not agree that they will be informed about unexpected medical findings, they cannot participate in the study.
• Employees of the research group *Thermu* are excluded from participation.

Study design

Design

Study type:	Interventional
Intervention model:	Crossover
Masking:	Open (masking not used)
Control:	Uncontrolled
Primary purpose:	Basic science

Recruitment

NL

Recruitment status:	Recruitment stopped
Start date (anticipated):	25-01-2015
Enrollment:	60
Type:	Actual

Ethics review

Approved WMO Date:	04-08-2014
Application type:	First submission
Review commission:	METC academisch ziekenhuis Maastricht/Universiteit Maastricht, METC azM/UM (Maastricht)
Approved WMO Date:	20-04-2016
Application type:	Amendment
Review commission:	METC academisch ziekenhuis Maastricht/Universiteit Maastricht, METC azM/UM (Maastricht)

Study registrations

Followed up by the following (possibly more current) registration

No registrations found.

Other (possibly less up-to-date) registrations in this register

ID: 25849
Source: Nationaal Trial Register
Title:

In other registers

Register	ID
CCMO	NL49108.068.14
OMON	NL-OMON25849

Study results

Date completed:	31-03-2017
Actual enrolment:	63