

Texte zu EU-Regelungen zur umweltgerechten Produktgestaltung und zur Energieverbrauchskennzeichnung in der Beleuchtung – Zusammenstellung^[1] des Umweltbundesamtes (UBA), Deutschland



Diskussion über eine künftige Änderungsverordnung (Produktgestaltung und -information)

Informelles Interessensgruppentreffen am 19. Februar 2020:
SVM-Höchstwert: Vortrag von Frau Malgorzata Perz, Signify

Hinweis: Bitte beachten Sie, daß der angehängte Text nur in Englisch verfaßt ist.

EN: Information on EU Lighting Regulations – Ecodesign and Energy Labelling – Compilation^[1] of the Federal Environment Agency (UBA), Germany

Discussion of a future amending regulation (Product Design and Information)

**Informal stakeholder meeting on 19 February 2020: Presentation
SVM maximum value: Presentation by Mrs. Malgorzata Perz, Signify**

FR: Informations sur réglementations de l'UE concernant l'éclairage – l'écoconception et l'étiquetage énergétique – Compilation^[1] de l'Agence Fédérale de l'Environnement (UBA), Allemagne

Discussion d'un futur règlement modificatif (Conception des produits et informations sur les produits)

**Réunion informelle des parties prenantes le 19 février 2020 :
La valeur maximale du SVM : Exposé par Mme. Malgorzata Perz, Signify**

Indication : Veuillez noter que le présent texte n'est disponible qu'en anglais.

^[1] <https://www.eup-network.de/de/eup-netzwerk-deutschland/offenes-forum-eu-regelungen-beleuchtung/dokumente/texte/>

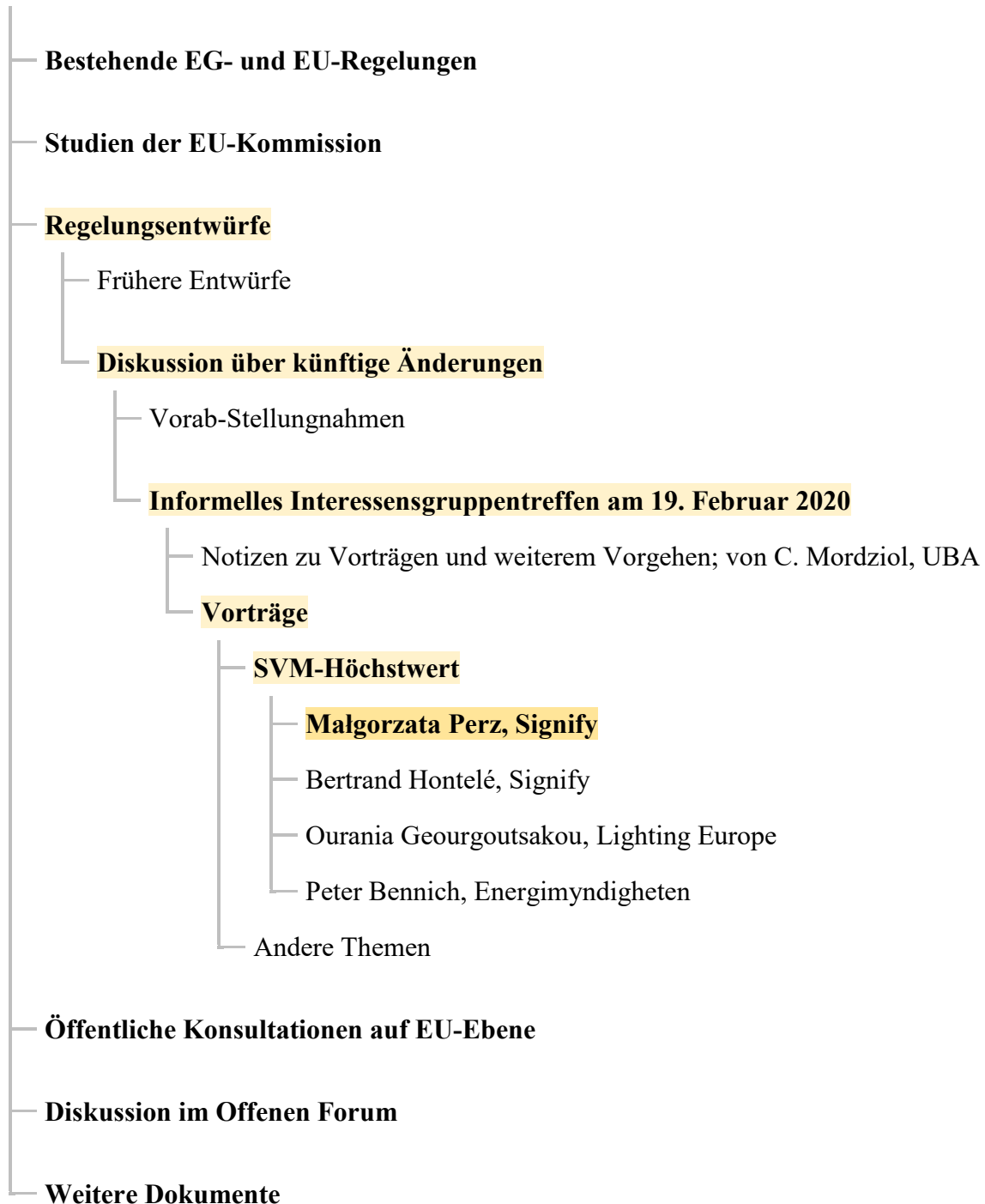
DE: ↓

EN: → page III

FR : → page IV

Texte im Offenen Forum

(abc = vorliegender Text)



Abkürzungen: • EG = Europäische Gemeinschaft • EU = Europäische Union • SVM : Maß für die Sichtbarkeit des Stroboskopeffektes • UBA = Umweltbundesamt

Documents in the Open Forum

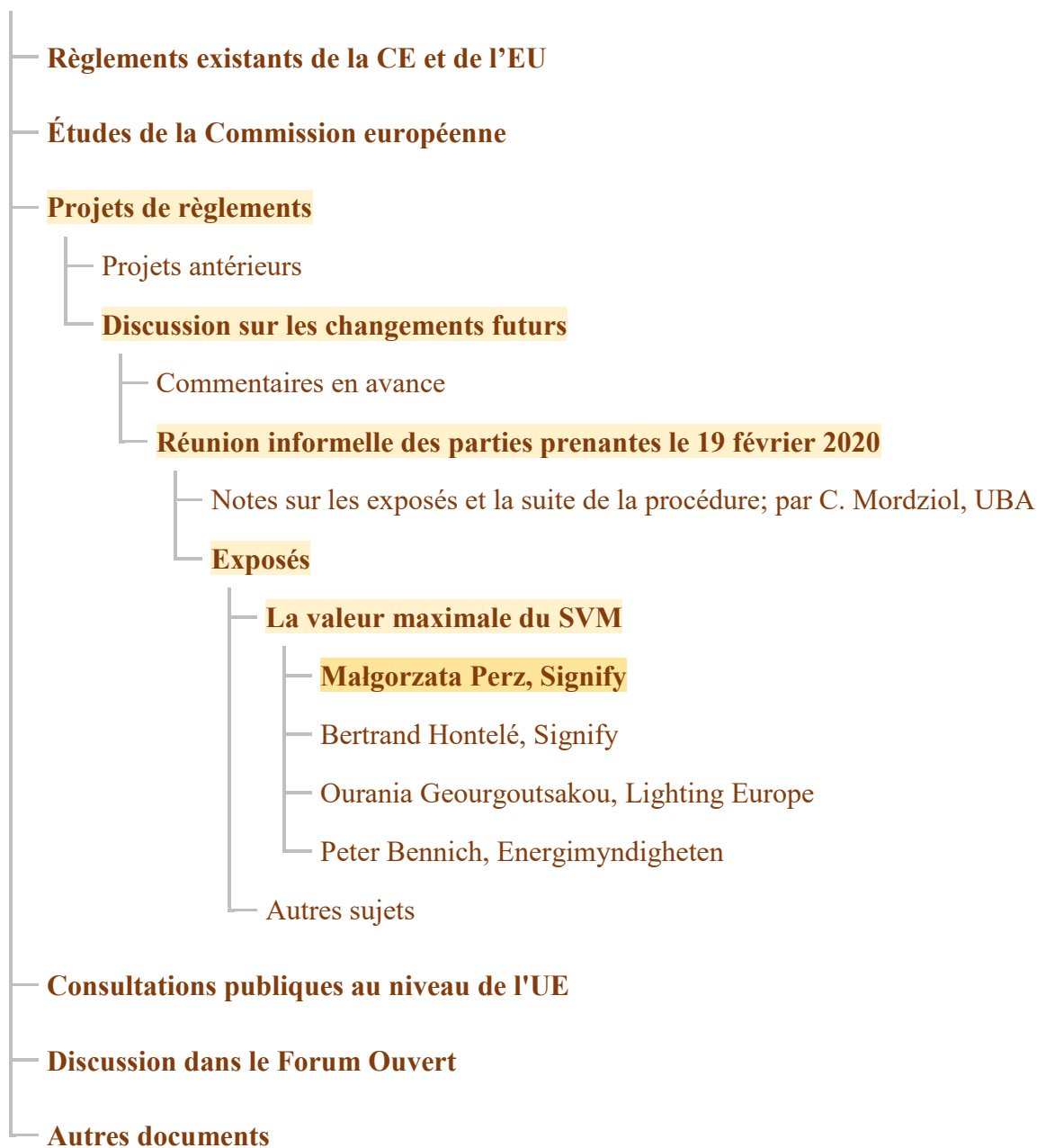
(**abc** = text at hand)



Abbreviations: • EC = European Communities • EU = European Union • SVM = Stroboscopic Visibility Measure • UBA = Umweltbundesamt (Federal Environment Agency, Germany)

Documents dans le forum ouvert

(**abc** = présent document)



Abréviations : ● CE = Communauté européenne ● SVM : Indice de visibilité de l'effet stroboscopique
● UBA = Umweltbundesamt (Agence Fédérale de l'Environnement, Allemagne) ● UE = Union européenne

Es folgt ein unveränderter Originaltext.

EN: The following is an unmodified original text.

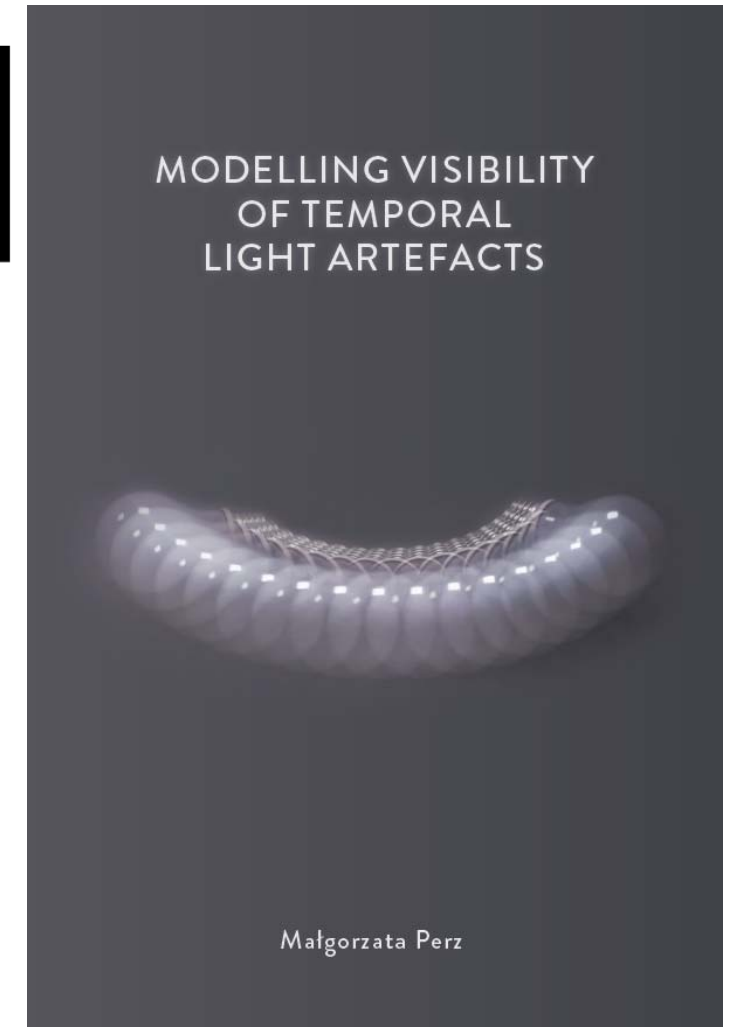
FR: Ce qui suit est un texte original.

Predicting visibility of the stroboscopic effect

Stroboscopic Visibility Measure - SVM

Małgorzata Perz, PhD

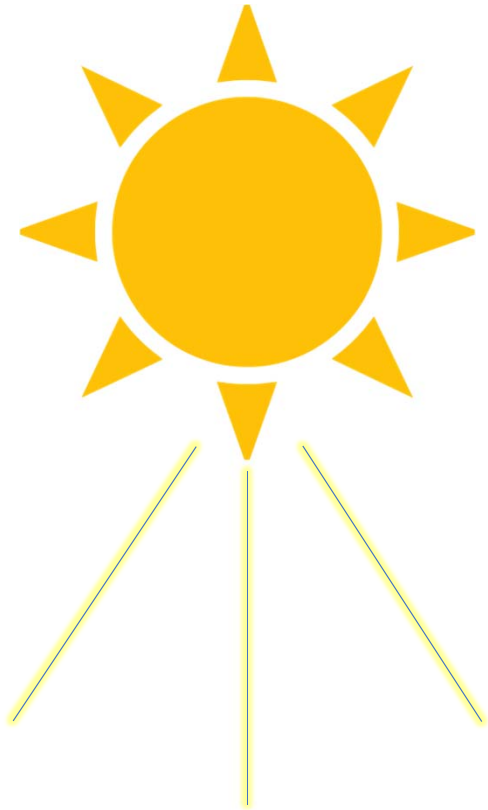
Introduction



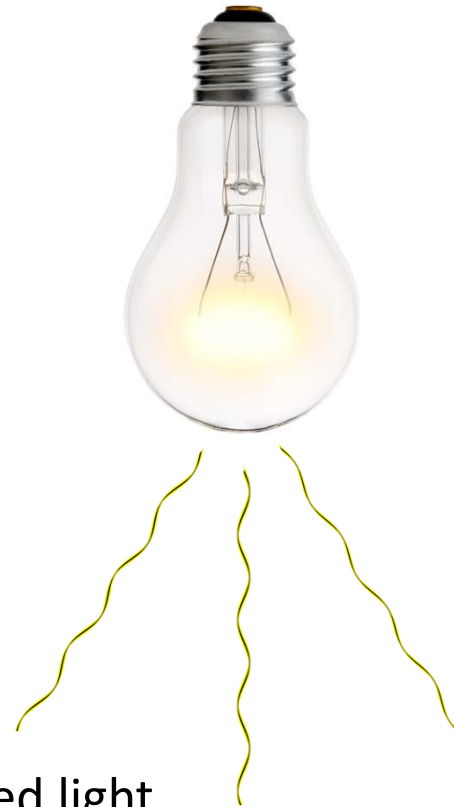
2013 – 2019: doctoral candidate at TU/e & ILI

- PhD cum laude
- Thesis: Modelling visibility of temporal light artefacts
 - Chapter 4
 - **development of the SVM**
 - published in Lighting Research & Technology
 - Chapter 5
 - **validation of the SVM**
 - published in Journal of the Optical Society of America

Daylight vs electric light



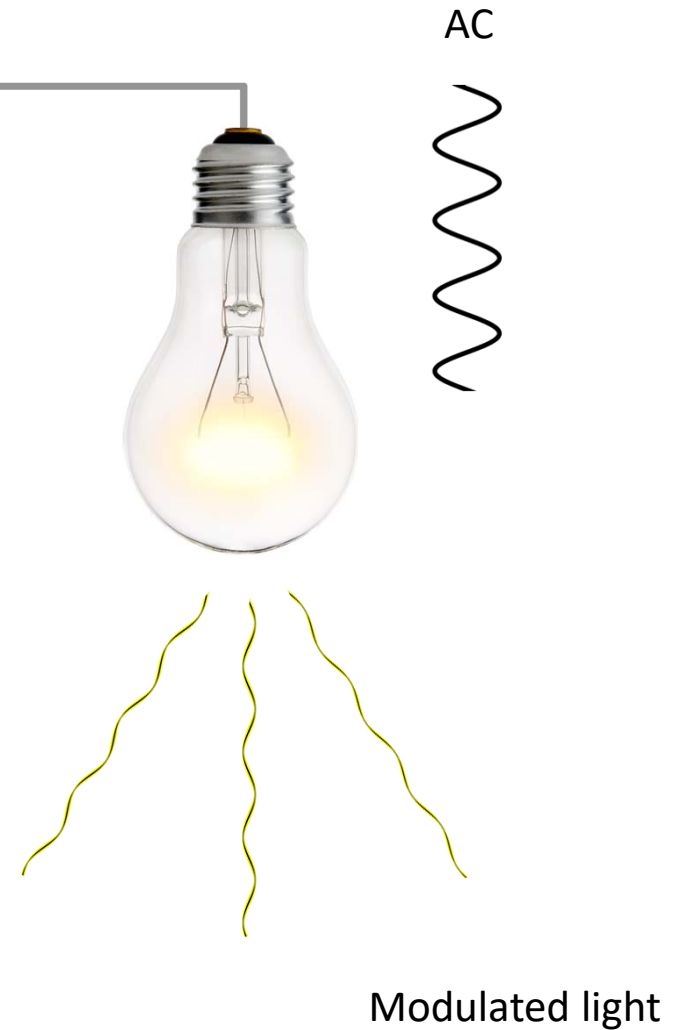
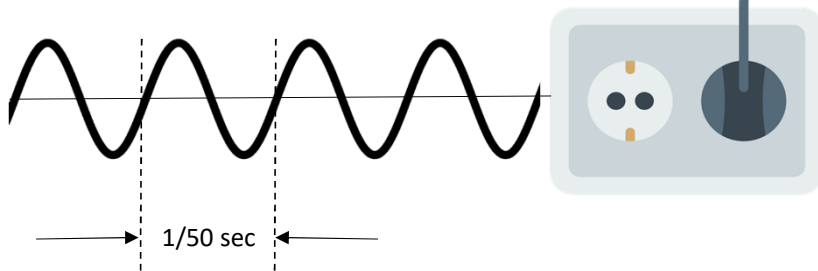
Constant light



Modulated light

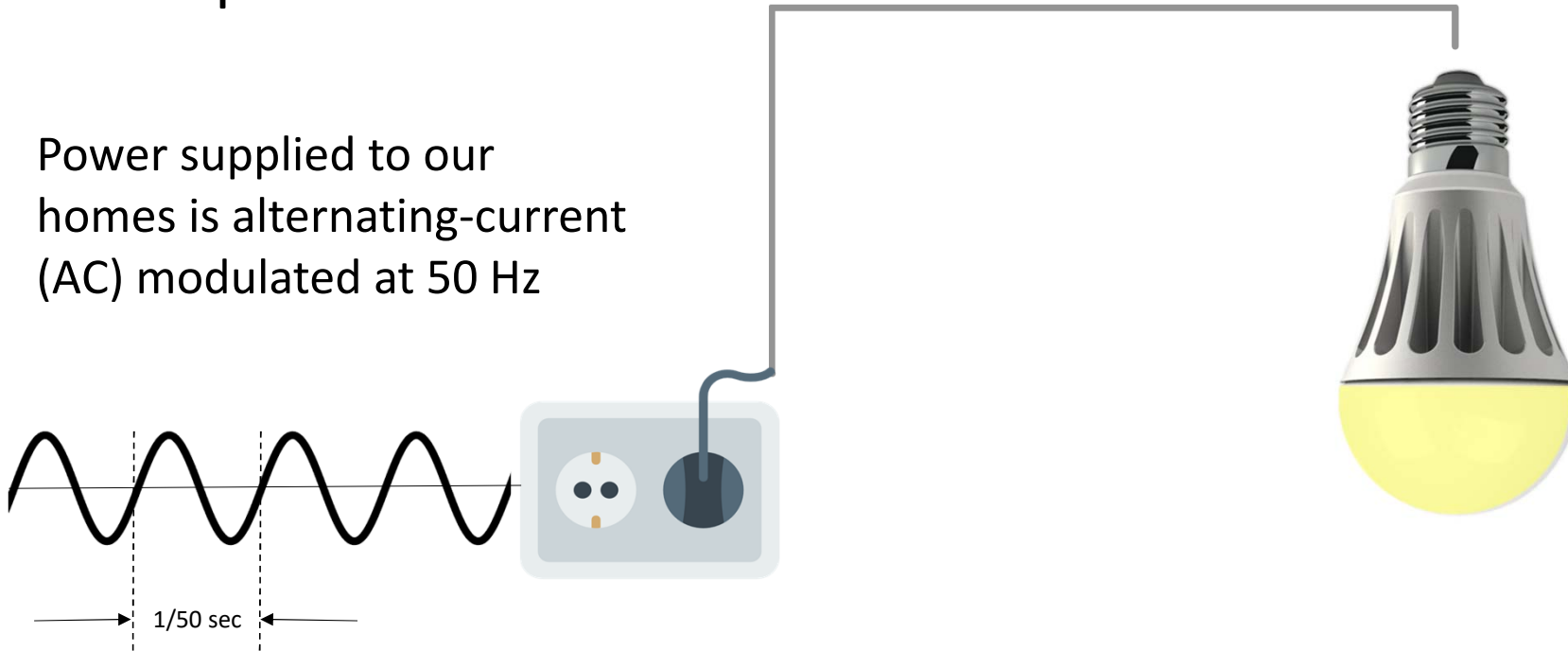
Mains power

Power supplied to our homes is alternating-current (AC) modulated at 50 Hz



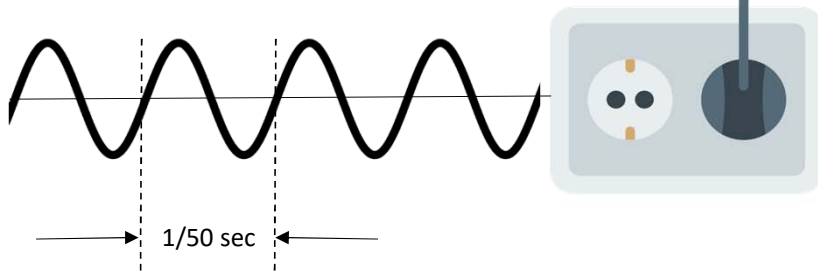
Mains power

Power supplied to our homes is alternating-current (AC) modulated at 50 Hz

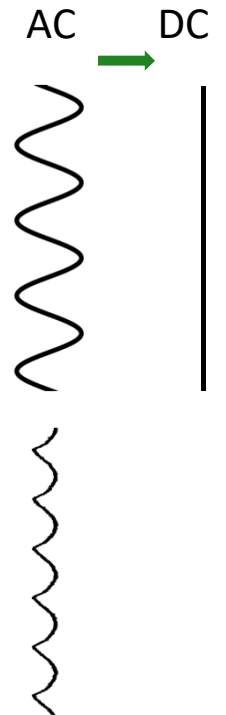


Mains power

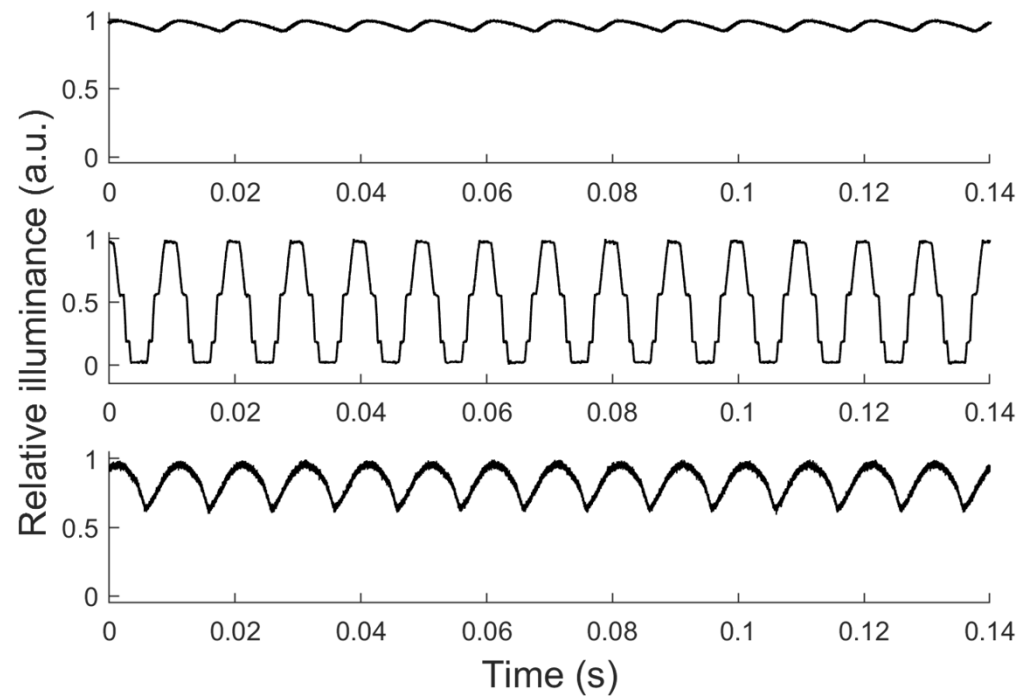
Power supplied to our homes is alternating-current (AC) modulated at 50 Hz



LEDs



Temporal Light Artefacts



Modulation of
LED light
output can give
rise to
**temporal light
artefacts**



Temporal Light Artefacts

1. Flicker

Directly visible change of brightness

2. Stroboscopic effect

Unnatural break-up of motion

What is stroboscopic effect

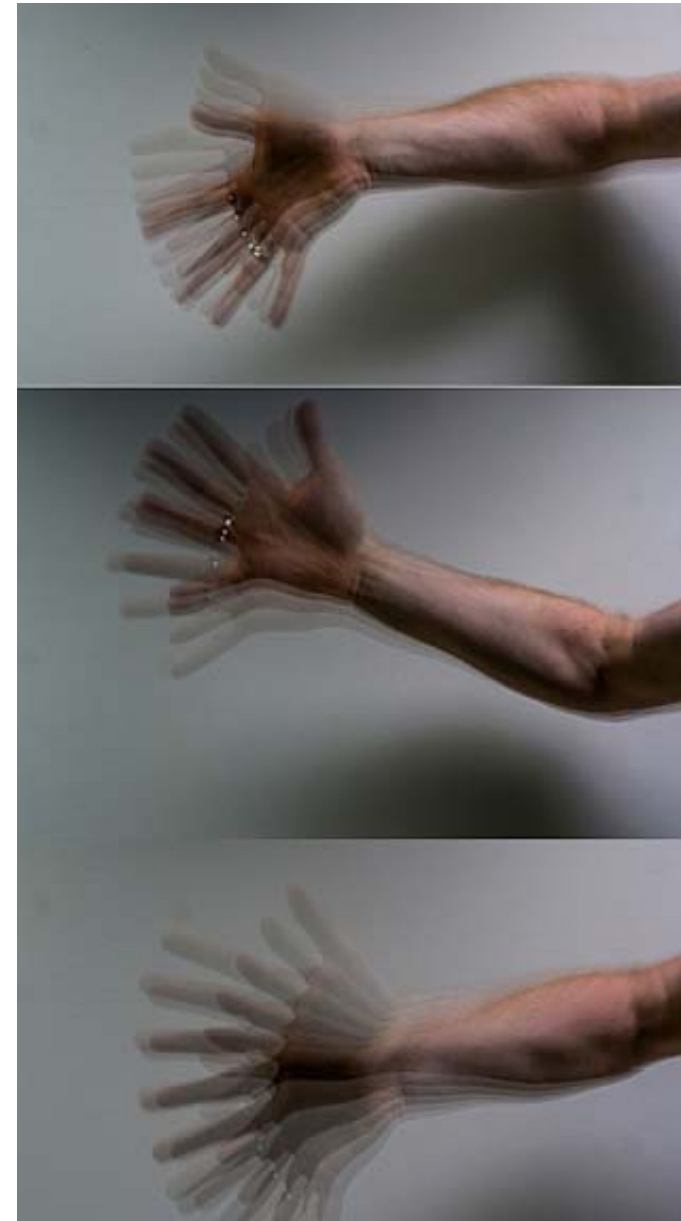
Stroboscopic effect: **unnatural break-up of motion**

Stroboscopic Visibility Measure, SVM

- A measure predicting **visibility** of the stroboscopic effect
- A number that tells whether the stroboscopic effect is visible or not
 - $SVM > 1$: the stroboscopic effect is **visible**
 - $SVM < 1$: the stroboscopic effect is **not visible**

definition

$$SVM = \sqrt[3.7]{\sum_{m=1}^{\infty} \left(\frac{C_m}{T_m}\right)^{3.7}} \quad \left\{ \begin{array}{l} < 1 \text{ not visible} \\ = 1 \text{ just visible} \\ > 1 \text{ visible} \end{array} \right.$$



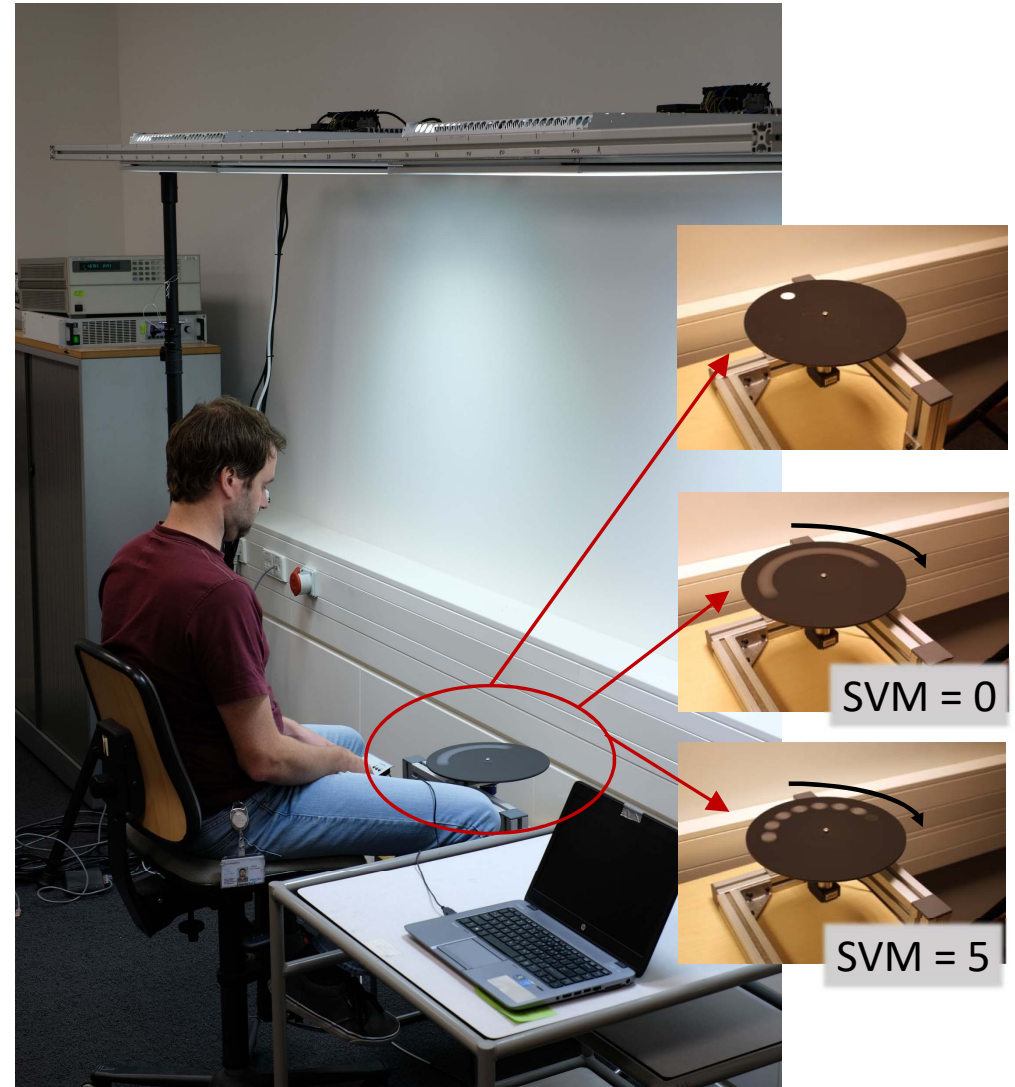
What is SVM

A number that tells whether the stroboscopic effect is visible or not. See demo.

- $SVM > 1$ is visible
- **$SVM = 1$** is just visible
- $SVM < 1$ is not visible

A number that tells the stroboscopic effect visibility in **laboratory conditions (worst case realistic scenario)**:

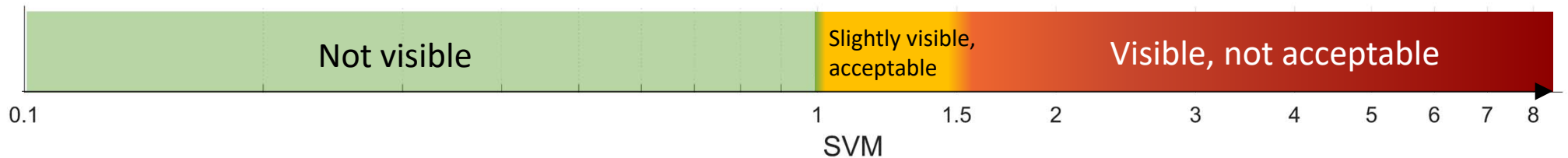
- For informed (sensitized) observer
- High contrast moving stimulus
- No daylight or other light sources



People find some levels of stroboscopic effect acceptable

SVM ranges between 0 and ~8.7.

Results of **5** acceptability studies show that slightly visible stroboscopic effect is acceptable in general illumination applications, like an office:



SVM is not predicting health-related issues

visibility \neq acceptability \neq health-related effects

Experiment shows no health effects from moderate SVM

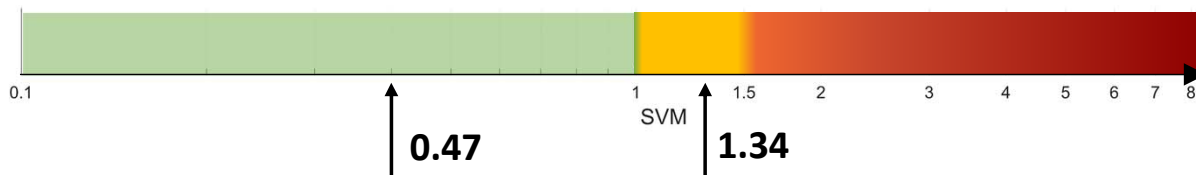
Journal publication (peer-reviewed): “Effects of long-term exposure to stroboscopic effect from moderate level modulated light.”

Results of the long-term (13 weeks) study

SVM = 1.34 did not significantly increase the occurrence of any health and wellbeing parameters (like eyestrain and headaches) tested.

Method

- Open office and electronics workbench
- Two light settings: **SVM = 0.47** and **SVM = 1.34**



- **46** uninformed participants
- **2813** completed questionnaires about health and wellbeing



Conclusions

- The stroboscopic effect is caused by the AC mains power (and it depends on the driver electronics)
- Stroboscopic effect is the **unnatural break-up of motion**
- SVM is developed to predict the **visibility** of the stroboscopic effect
- **The visibility threshold of SVM is 1** by definition
- The stroboscopic effect can be slightly visible and still **acceptable**
- A long-term study shows that $SVM \leq 1.34$ (at least – higher values were not tested) did **not cause health problems** (eyestrain, headache).
- **SVM is not predicting health-related issues**