Bartenbach
research & development

Modern lighting systems
which put human needs in the foreground

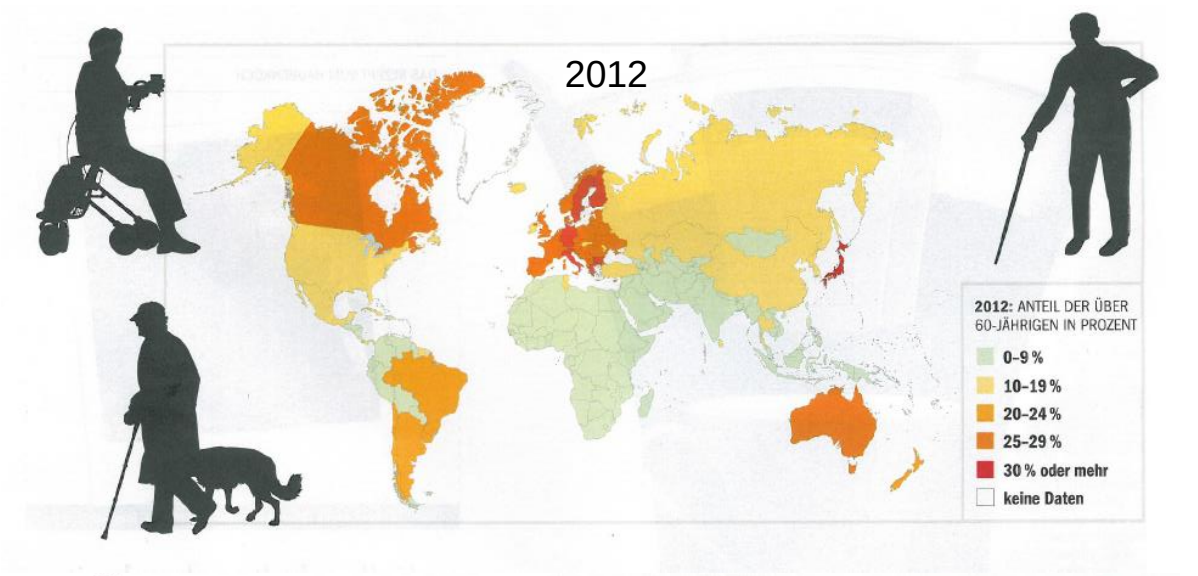
Daniel Föger

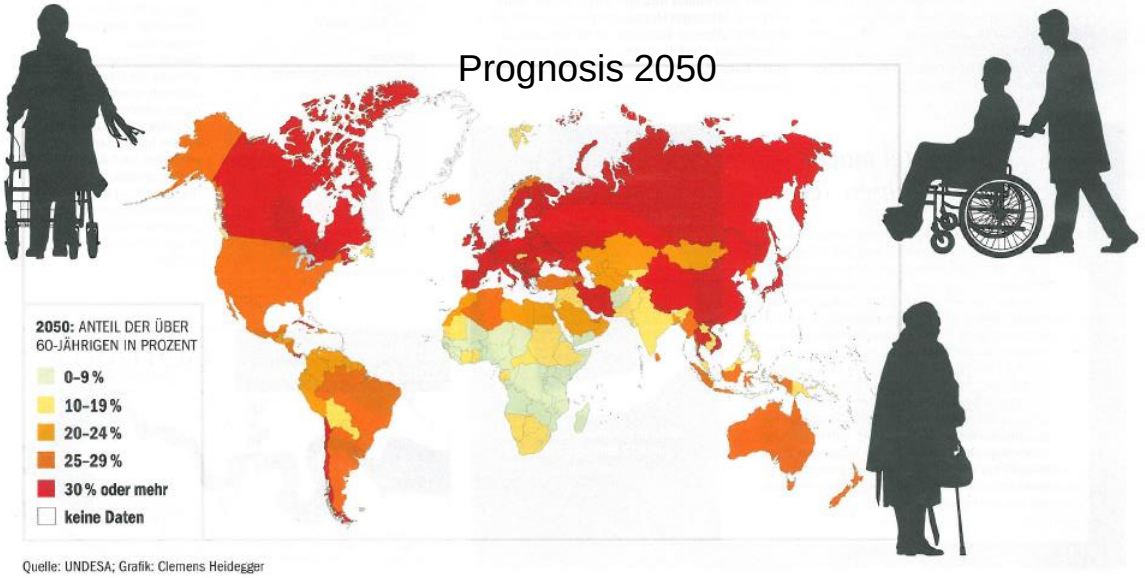
Outline

1. Introduction
2. New lighting concept
3. Implementation in research projects
4. Conclusion

Demographic change

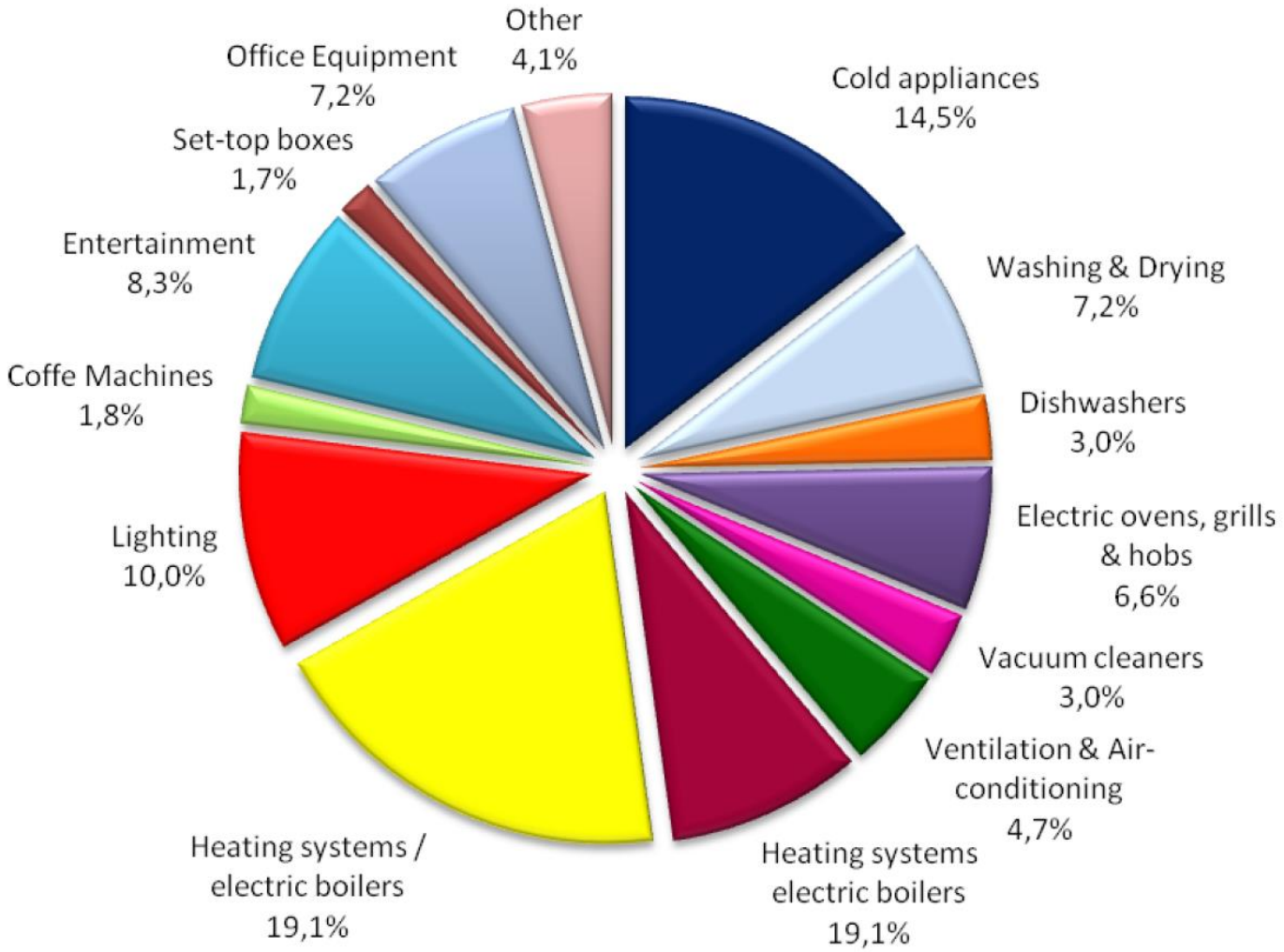
UNO-Report





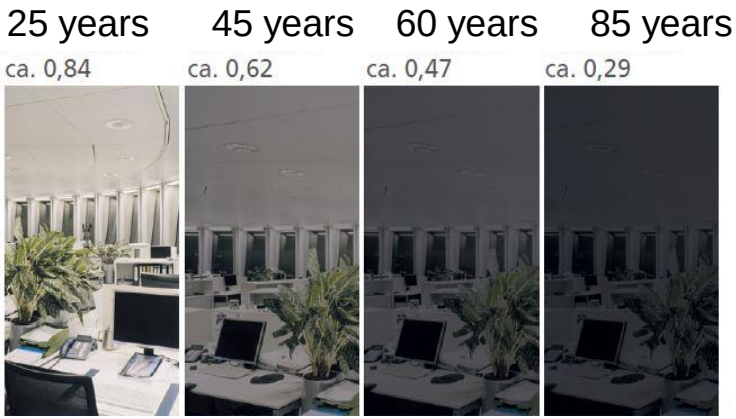
Residental electricity consumption

EU-27

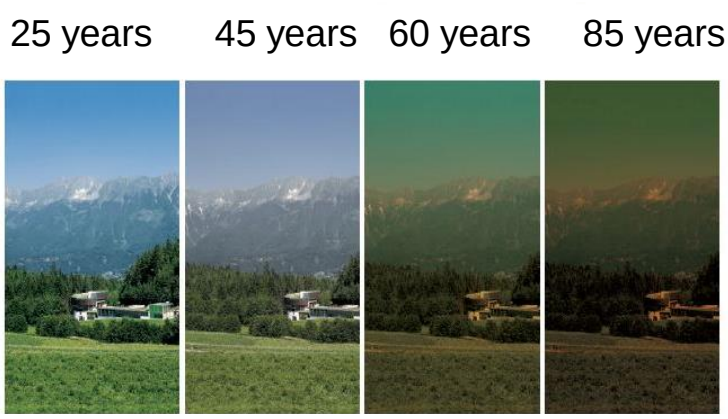


Source: JRC (2009)

Needs of elderly people



Brightness perception



Color perception

Increased glare sensitivity

Modified spectral lenticular transmission

Reduced pupil size

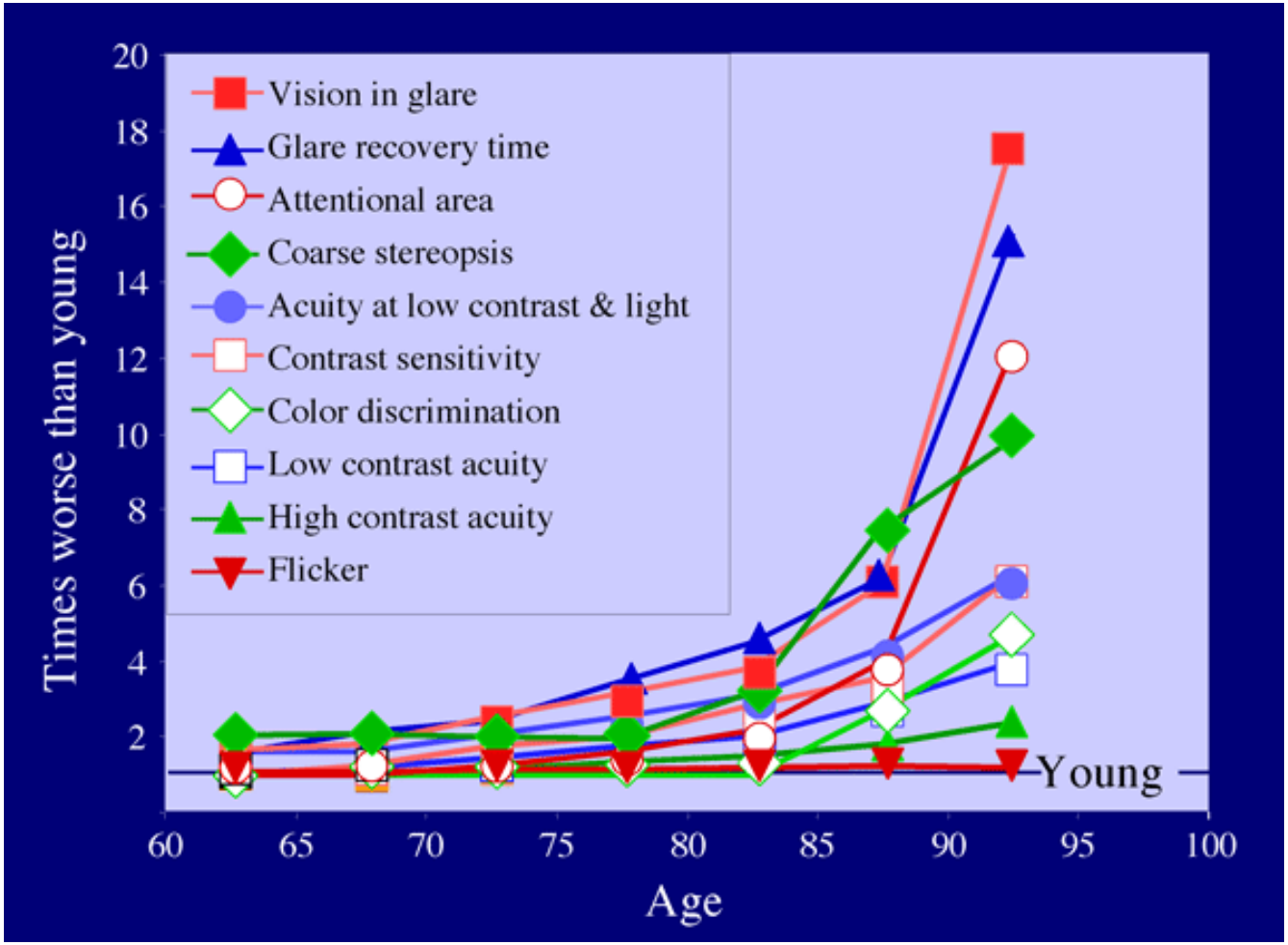
Reduced lenticular transmission

Elderly people (65 +) **Perception-psychology**

BIOLOGICAL Lighting needs

VISUAL Lighting needs

Needs of elderly people



Brabyn JA, Schneck ME, Haegerstrom-Portnoy G., and Lott L. The Smith-Kettlewell Institute (SKI). Longitudinal Study of Vision Function and Its Impact Among the Elderly: An Overview, *Optom Vis Sci.2001; 78(5):2464-269.*

As it is - lighting in dwellings

General issues

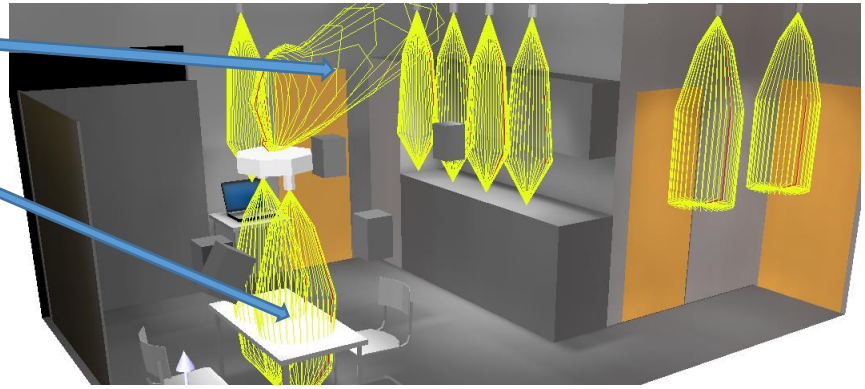
- Diffuse light
- Low brightness
- Dark corridors
- Inhomogeneous illuminance
- dark surfaces

Low Illuminance of the working area **< 250lx**

New lighting for fulfilling human lighting needs in (smart) domestic appliances

New lighting concept

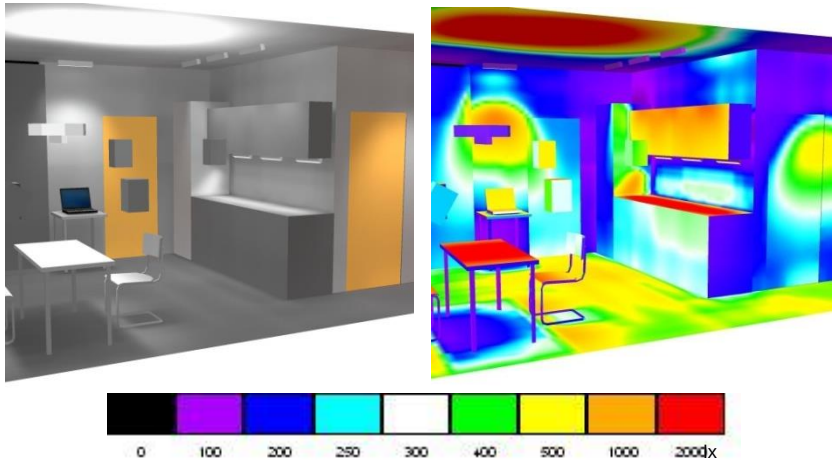
1. Split into ambient light
   zonally task light



2. Control curve adjusted to individual circadian rhythm

3. Automated switching due to presence (PIR sensors)

4. Manually overriding by customer



Light concept for elderly people

Higher light demand (intensity)

=> task area up to 3000lx, general lighting 300lx

Higher glare sensitivity

=> non-glaring luminaires for task areas

Higher brightness homogeneity

=> uniform ambient lighting through indirect ceiling lighting

Individual time-dependent variation of light intensity and light colour

=> clear day/night signals: 4000K / 2200K and intensity variations

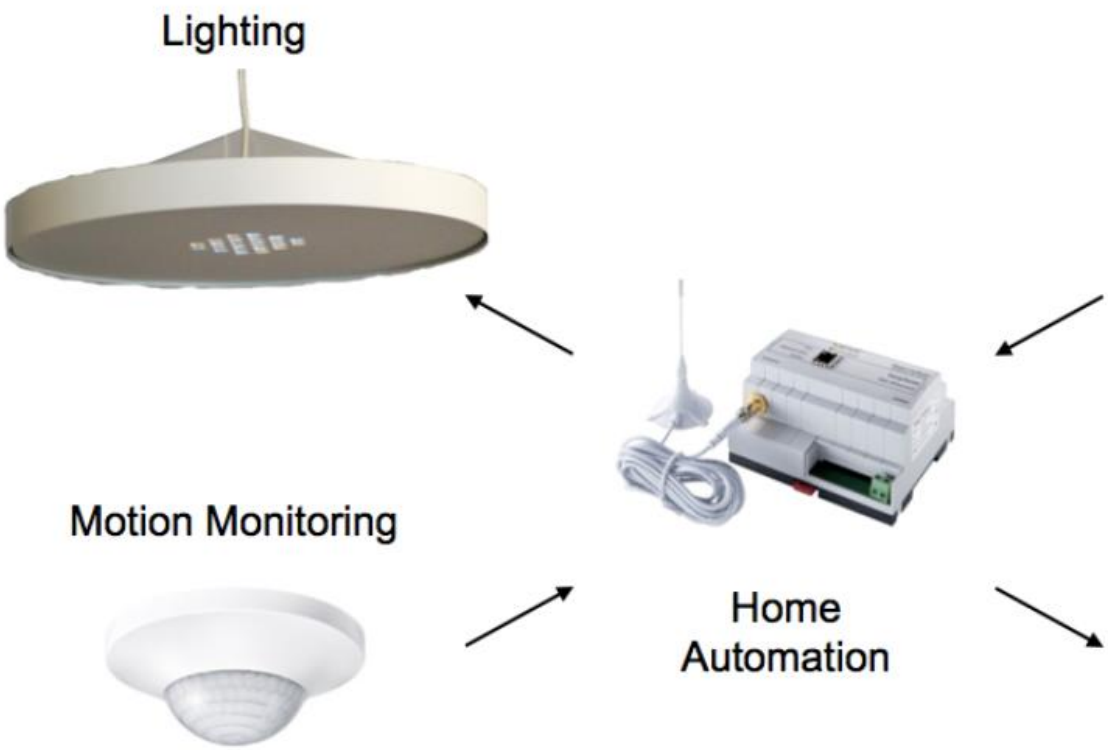
Implementation in research projects

Guiding Light

Ambient Light Guiding System for the Mobility Support of Elderly People (Guiding Light)

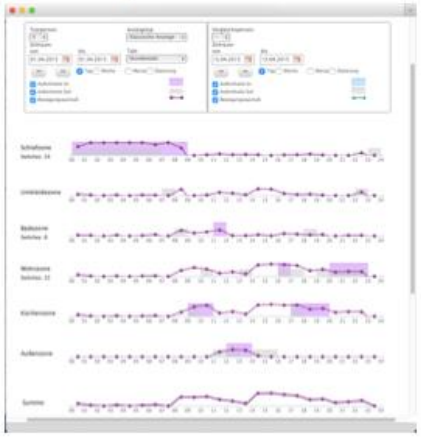
System architecture (wireless)

„Guiding Light“



Light Editor

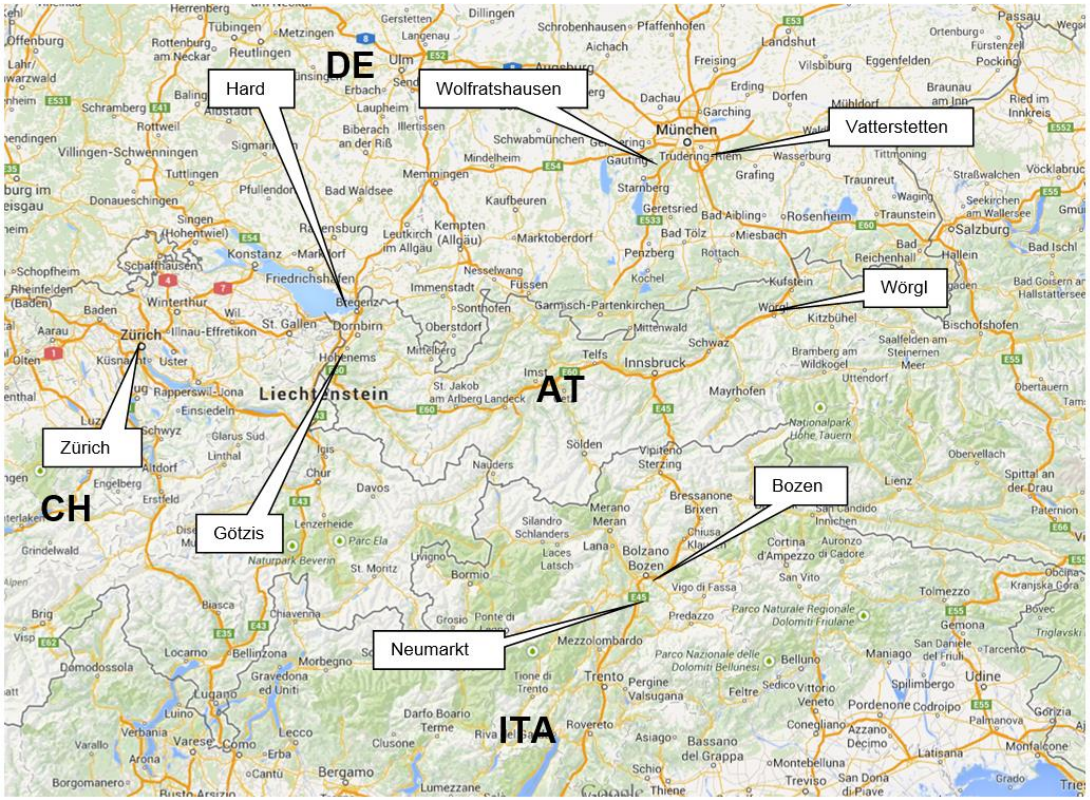
Mobility Monitor



enocean®

Demo cases in Guiding Light Project

11 households (and control group of 8)



Guiding Light

Partner

myVitali

TRIDONIC
enlightening your ideas

apollis

YOUSE
real users, real innovation

FHV
Vorarlberg University of Applied Sciences

AAL
AMBIENT ASSISTED LIVING

Privat houses – primitive state

Privat houses – with Guiding Light

Results - survey

- Better (dynamic, glare free) light in homes contributes significantly to the subjective feeling of **well-being and quality of life**.

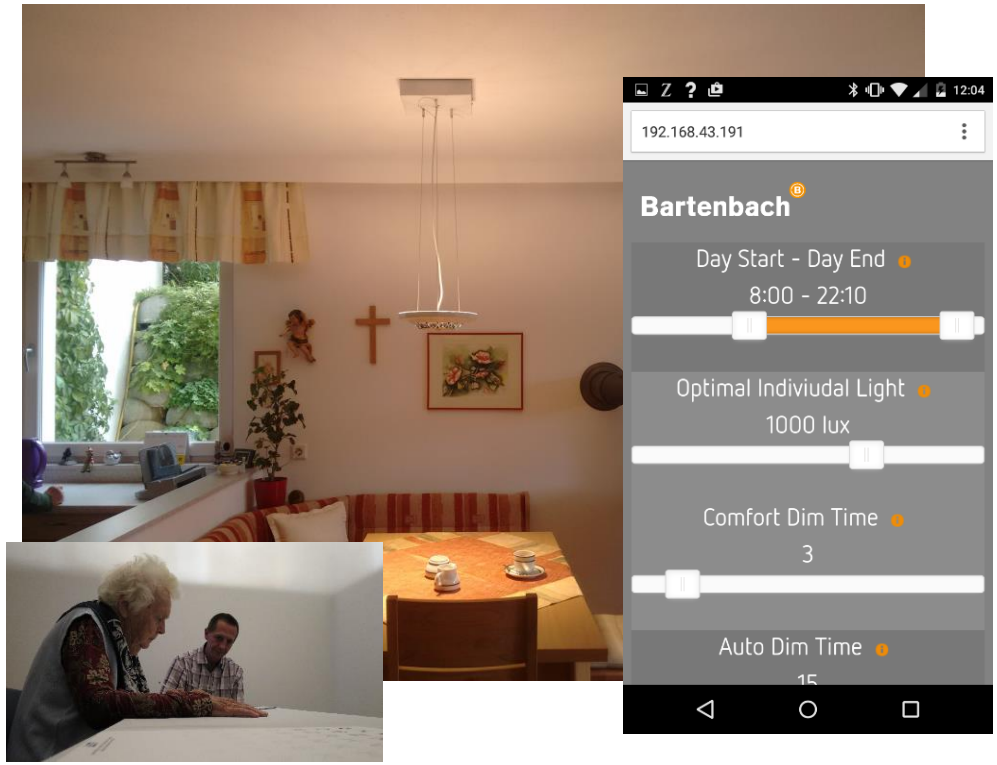
- Light is a subtle, in the background acting factor, which is overlaid by a variety of short-term, acute factors (e.g. disease, stroke of fate, conflicts, worries)

-> Selected findings on the following slide

Selected findings

- Automatic light in windowless rooms (bathroom, corridor) is expressly desired (residential area problematic)
- Biologically effective light at constant energy costs (compared to the primary situation)
- 2200K (“extreme warm white”) perceived as pleasant and accepted
- Zonal “task lighting”: high intensities preferred

Light4U



2014-2016

- Adaptive CCT-Curves (2200K-4000K) and LUX-Levels (0-4000lx) producing individual day-night signals
- PIR-Sensor sustains visual needs during daytime
- Power of 60W
- Decentralized architecture (No Cloud, No Gateway) with Enocean switch
- Open Source Solution written on Python (@Raspberry PI)

MARS-Test – Contrast-Sensitivity

horizontal without shading

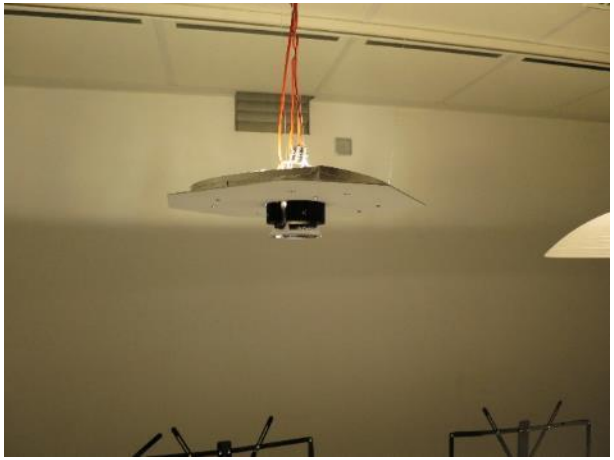
horizontal with shading

vertikal without shading

Goal: Measuremtent of the visual absolut threshold

Laboratory study

RDB-Version



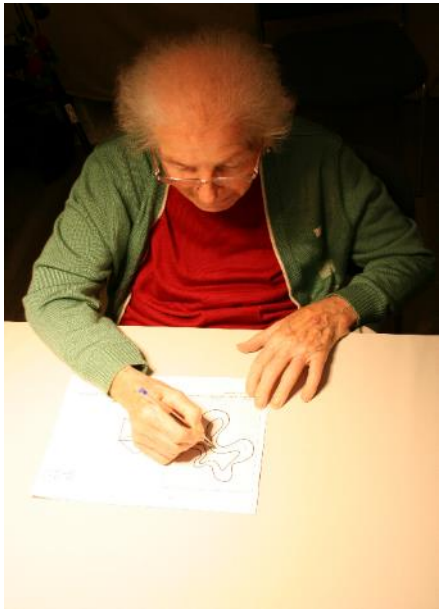
COB-Version

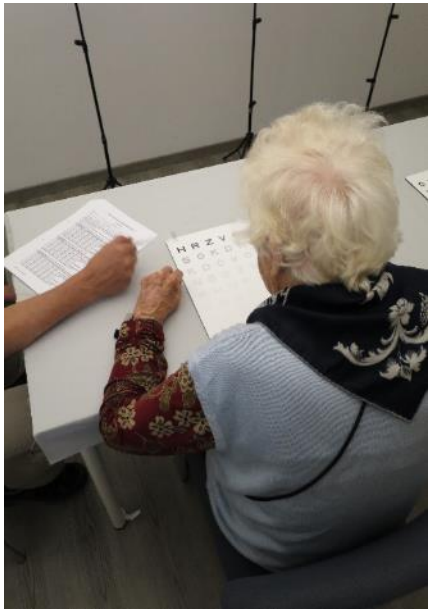
Standard-Version

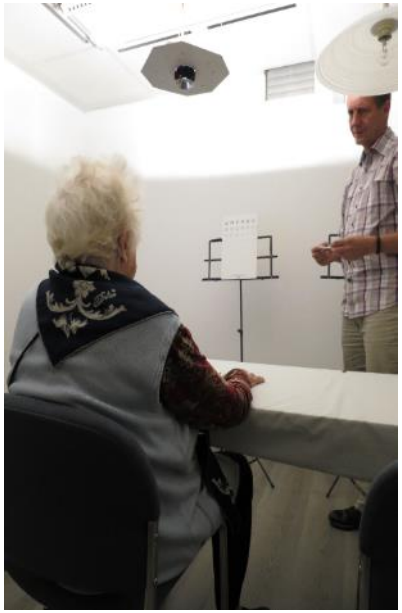
Horizontal Illuminance Levels

RDB	4050 lx
COB	120 lx bzw. 4050 lx
Standard	120 lx

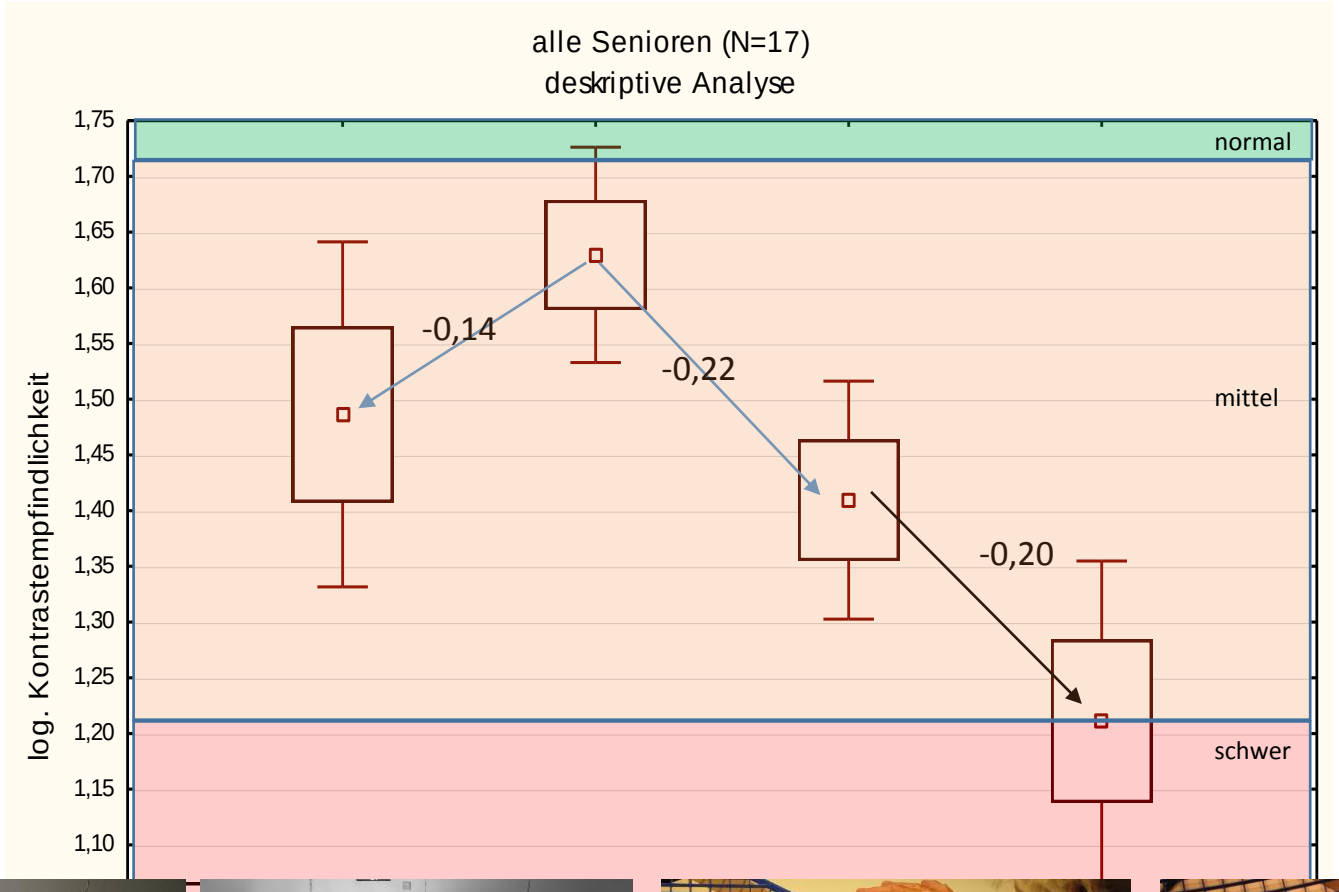
Test-Mockup

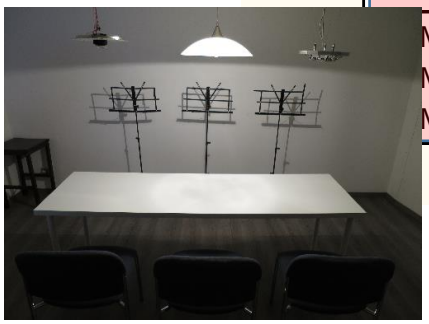


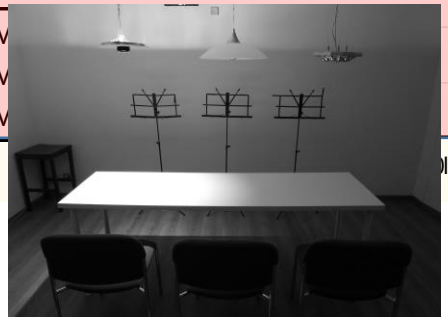


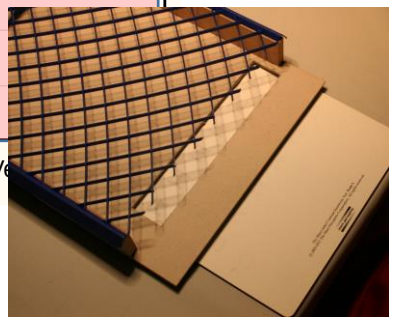


Results Summary









Summary of findings:

Percieved Brightness:

Glare free lighting systems allow very high brightness levels (here up to 4000lx) on task areas. The high illuminance level can compensate negative effects from age-related loss of vision slightly.

Shading:

Elderly people try to improve their vision by reducing the typical visual-distance. Shadows therefore are produced on the task area. These shadows have a strong negative influence into the contrast sensitivity. The creation of shadows and especially multiple-shadows has to be avoided. Shadows are having a stronger effect on the visual performance than typical glare effects.

Glare:

Diffuse emitting lighting systems with very high luminance levels reduce the visual performance and have to be avoided.

Thank you for your attention.

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Guiding Light

Light4U