

Summary of most important findings of the PILCS field study

Context: A large-scale field study was performed in order to validate the PILCS personalized lighting control system in real-life office settings. To test the effects of the novel system on employees' wellbeing, sleep, performance and evaluations, we employed ecological momentary assessment including self-report and ambulatory measurements to measure employees' affective state, performance, and lighting appraisals while employees were exposed to the personalized, dynamic scenario or the commonly experienced, static scenario during their daily routine at work. In addition we logged interactions during one week of full user control.

Results on light exposure: The light measurements close to the eye showed a higher illuminance level in the early morning in the personalized, dynamic lighting vs static lighting scenario. The CCT level at the desk and close to the eye were higher in the personalized, dynamic scenario, regardless of the time interval. These findings correspond largely with the employed scenario. This is an important finding that demonstrates the efficacy of a personalized system in providing individual users with personally tailored light settings. **Users of the personalized scenario did indeed receive better tuned lighting exposure**, in spite of the fact that they were mobile and that daylight contributions were allowed in all conditions.

Effects on alertness, wellbeing and sleep: **We were already able to demonstrate a substantial improvement in sleep duration:** People reported to have slept 26 minutes longer on average in the personalized scenario. **The preliminary analyses have not yet revealed clear beneficial effects on employees' affective state, subjective performance, or vitality.** These may still emerge when more advanced analyses target specific user groups and control for actually received light doses.

We will be performing additional analyses to control for potential confounding variables (such as light sensitivity, general sleep quality and period of assessment) as well as for actual light exposure as measured with the light loggers. This means that the current findings should be considered with caution as they are still inconclusive.

User experiences: Overall, the participants were positive about the PILCS system. Most appreciate the personal control offered and the fact that light conditions can be tuned in intensity and colour temperature to accommodate individual needs. **The user interface was considered clear and easy to use.** It can basically be used as is, however it needs to function in all browsers and it would need to be made accessible without needing to use a computer. A quick on/off button and perhaps presence detection would be much appreciated.

With regard to the light scenarios, the thing that strikes most is the diversity in opinions on light intensity and colour temperature. These findings clearly illustrate the need for personal control – comfort is a very important, but also very personal phenomenon. Particularly when one considers offering more ‘extreme’ (i.e. bright or very blue) scenarios, persons should be able to make adjustments. We learned that even though personal control is exerted only incidentally, **users emphasize how much they appreciated being able to tweak the light settings in the PILCS interface.**

User awareness of vitalising effects and health benefits: Only few participants appeared aware of any alertness-, health- or productivity enhancing effects of light in general. If granted control, most participants report tuning conditions to visual comfort, which is of course only one component of light’s effects. This presents a barrier to large-scale commercialization of advanced lighting solutions and should be addressed by the professional lighting domain.