

ELECTRIC LIGHTING SATISFACTION

Research Brief

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Figure 1:

Improved visual comfort
leads to higher satisfaction

Source: <https://www.nytimes.com/2019/07/16/business/the-next-chapter-in-the-evolution-of-the-open-workplace.html>

Keywords:

Electric Lighting, Visual
Comfort, Satisfaction,
Advanced Lighting
Controls, Productivity,
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CONTENT OVERVIEW

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- III. Work Environment as Compensation
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ELEC. LIGHTING + SATISFACTION SUMMARY

Electric lighting is a critical piece of the puzzle when assessing employee satisfaction with their work environment. Underlit spaces lead to reduced visual comfort, causing eye strain, headaches, and fatigue that reduce satisfaction and productivity. A luminaire's correlated color temperature (CCT) should be considered because research has shown that preference for warmer or cooler temperatures varies significantly by demographic attributes. Research has also demonstrated that employees consider the work environment as part of their compensation, which means it is imperative that employers carefully consider the overall quality of the lighting within their work environment.

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I. Improved visual comfort in the workplace leads to higher building-occupant satisfaction and productivity

Research by Silvester et. al. suggests that lighting is one of several factors that combine to create a healthy work environment that promotes employee engagement, well-being, and increased productivity. Employee satisfaction and retention was also noted to be higher in instances where worker-controlled lighting solutions were utilized to meet the needs of individual users. In addition to performance and satisfaction, they concluded that there is evidence for a link between lighting conditions and biological health conditions, especially as it relates to shift-working environments. Overall, they believe employers should consider investing in workplace lighting as a means to develop healthy work environments that support well-being and performance.

Henri Juslén and Ariadne Tenner have explored the effects of workplace lighting changes on employee performance. They believe a change in workplace lighting can effect employee performance through the following mechanisms: visual performance, visual comfort, visual ambiance, interpersonal relationships, biological clock, stimulation, job satisfaction, problem solving, the halo effect, and the change process. For example, employing high-frequency ballasts or LED technology instead of using magnetic ballasts limits flicker. Flicker can cause eyestrain and fatigue that results in lower sustained performance. Decreasing that fatigue and eyestrain through updated lighting technology can lead to increased individual performance.

The post-occupancy case studies reviewed by Doulos et. al. revealed the importance of understanding the human factor as you design the lighting, both natural and artificial, within a space. Leveraging lighting control systems that react to the available daylight within a space is a great way to save energy, while maintaining a high-quality visual environment, but it is important to conduct post-occupancy evaluations to determine overall satisfaction with the controls. Their study found that age impacted overall visual satisfaction, with older users preferring more light than younger users. However, the common theme among users was that natural daylight is preferred and any electric lighting control system should have a manual override that allows users to switch it on and off at will. Their review found that visual comfort was ranked highest among employees, which reiterates the vital consideration that employers must take when thinking about a lighting system in a new construction project or even an office renovation.

II. Personal control of an individual's lighting system leads to higher satisfaction and typically a reduction in energy consumption

Research by Newsham et. al. concluded that the ability to control lighting and flow rate of ventilation based on individual preferences led to greater satisfaction with the office environment. Not only did the controls lead to higher satisfaction, but they found that individual preferences actually led to an increase in energy savings. Over the course of a day, their study revealed two to three control actions from users, but in a long-term pilot study (several months) those actions reduced to just one control action per person per day. Lastly the study found that during load-shedding situations, those with personal control were less affected compared to the participants with no personal controls. As more advanced lighting control systems enter the market, especially luminaire-level control systems, personal control integration provided opportunities to increase employee satisfaction with their work environment, while also saving energy.

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Robert Baron, Mark Rae, and Susan Daniels investigated the effects of indoor illuminance and spectral distribution on cognitive tasks and interpersonal behaviors. Their study found that gender played a role in preference (men preferred opposite conditions compared to women), which suggests individual control over spectral distribution (color) and illumination would allow users to create their ideal environments. When an employee is in control of their work environment they are less distracted by those overall conditions, allowing them to focus and be more productive. This higher level of productivity can lead to increased satisfaction.

A comprehensive report put together by Alison Williams, Barbara Atkinson, Karina Garbesi, and Francis Rubinstein of Berkeley National Lab synthesizes energy-savings data from 240 saving estimates found in over 88 papers and case studies. The collected data was categorized into daylighting strategies, occupancy strategies, personal tuning, and institutional tuning. In conclusion they were able to provide best estimates of average energy savings potential for occupancy, daylighting, personal tuning, institutional, and when multiple strategies are employed simultaneously. They found that energy savings attributed to personal tuning resulted in roughly 30%, which is a great indication of how personal tuning not only results in more satisfied individuals but energy-savings as well. Overall, they found that the highest energy savings potential occurred when utilizing more than one method to reduce the energy consumption of your lighting system.

III. Employees value their work environment, and especially the visual environment, as part of their compensation package

Another study by Newsham et. al. investigated the relationship between indoor environmental conditions and job satisfaction. Through their field studies they found that well-lit work environments, which was provided primarily through windows, led to higher job satisfaction. In addition to lighting, they found that ventilation, privacy, and acoustics were other notable factors in overall employee satisfaction with their work environments. They also found that employee's opinion of their management, which was heavily influenced by the overall quality of their work environment, greatly impacted job satisfaction. Well maintained and quality indoor environments were seen by staff as a message of their value from the managerial levels of the company. This indicated that employees who are sufficiently compensated through a quality work environment will have higher job satisfaction.

An article by Martin Luenendonk summarized existing literature related to the non-energy impacts on employees in the work environment. Until recently updates to office lighting were seen as an aesthetic improvement or even a reduction in energy consumption, but current research suggests that lighting has more profound - biological - impacts on those employees in the space. With this in mind it is vital that lighting is carefully considered within an office setting because the wrong choice can lead to headaches, eye strain, poor sleep quality, fatigue, and an overall reduction in productivity. In order to facilitate a healthy work environment, carefully consider the correlated color temperature (CCT) of the light source, the degree of personal control of the lighting system (i.e., can employees adjust the light output to match their needs), and when possible prioritize natural daylight.

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IV. KEY REFERENCES

Primary Research

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