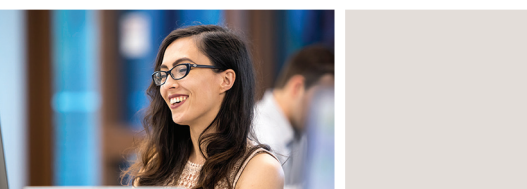
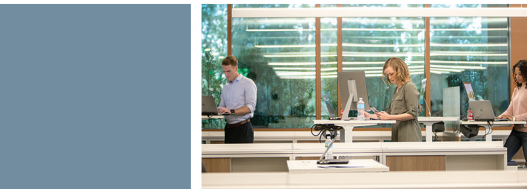
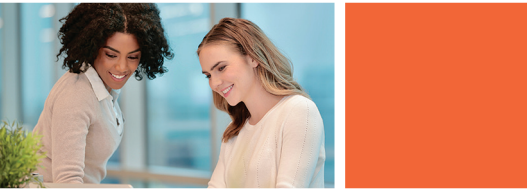




Daylight & The Workplace Study

How does natural light in the workplace improve employee physical health?



Executive Summary

Illuminating the Ideal Office Environment

The image of a workplace flooded with natural light seems great in theory, but in reality, the amount of light entering a space must be balanced with occupant comfort. When light penetration is uncontrolled, it can cause unwanted glare reflected off of computer screens and uncomfortably hot workstations. When it is controlled by lowering the blinds, on the other hand, it disconnects occupants from a view of the outdoors effectively eliminating the benefit of windows in the first place.

Key Findings

Employees in environments with optimized daylight and views provided by electrochromic glass windows reported a reduction in physical health symptoms commonly experienced by office workers.

- **63% fewer headaches**
- **56% less drowsiness**
- **51% reduced eyestrain**

Computer Vision Syndrome

Computer Vision Syndrome is a condition that in this new digital age impacts 70 million workers worldwide. Resulting from prolonged computer use and characterized by symptoms of eyestrain, blurred or double vision, and headaches, it has been shown to be exacerbated by harsh lighting conditions such as glare. Controlling daylight levels in offices while maintaining a view of the outdoors, which allow the eye to refocus and recover from fatigue, can reduce the risk of these symptoms and thereby help employees work comfortably for longer.

Research Methods

To better understand how daylight and views in the workplace impacts employee health and wellness, Dr. Alan Hedge of Cornell University conducted a study of 313 office workers across North America, some of whom worked in offices with conventional windows and blinds and some who worked in offices with View Smart Glass that intelligently optimizes daylight and views to the outdoors.

Results

Employees in workplaces with View Smart Glass reported fewer health symptoms that are commonly experienced by office workers. They reported 63% fewer headaches and 51% reduced eyestrain, symptoms that are commonly associated with glare and suboptimal lighting conditions. Employees also reported 56% less drowsiness, a symptom that is commonly associated with lack of daylight availability as well as uncomfortable thermal conditions.

Conclusions

Providing employees with optimized daylight and views unlocked significant benefits for employee health. These not only enhance the personal wellbeing of employees but also are key to organizational success – as a healthy and happy workforce is a successful workforce.



Cornell University



Research Methods

The Daylight & The Workplace study was conducted in seven offices in five cities across North America. 313 total office workers were recruited into the study from two offices with conventional windows and blinds and five offices with View Smart Glass.

To study the impact of optimized daylight and view conditions on their health and work experiences, the study participants were surveyed for the following factors: health (headache, drowsiness, and eyestrain), satisfaction, and perception of their environment.

The Expert

Dr. Alan Hedge is a Professor Emeritus of the Department of Design and Environmental Analysis at Cornell University. He directed the Human Factors and Ergonomics teaching and research programs at Cornell University and his expertise lies in the impact of design and workplace ergonomics, including office lighting conditions, on the health, comfort, and productivity of workers.

Dr. Hedge has authored over 50 book chapters and 250 articles on the subject of human factors.



Dr. Alan Hedge
Professor Emeritus of Design
and Environmental Analysis
Cornell University

Intelligently optimized natural light can reduce the risk of Computer Vision Syndrome symptoms by providing workers with greater access to natural light while significantly reducing glare conditions.

Furthermore, the American Optometric Association recommends self-treatment by utilizing the “20-20-20 rule” of looking into the distance at least 20 feet away, for 20 seconds for every 20 minutes of computer work. Unobstructed views of the outdoors can motivate workers to employ this rule more often, and therefore provides an element of recovery for Computer Vision Syndrome symptoms.

Exterior views and connection to nature has also been demonstrated to reduce stress in a variety of worker and non-worker populations, and stress is yet another direct cause of tension headaches and migraine.

The Results

Visual Comfort

Computer Vision Syndrome, also known as “digital eyestrain”, is a condition that impacts 70 million workers worldwide and results from prolonged computer use (i.e. three or more hours a day) with symptoms including eyestrain, blurred or double vision, and tension headaches^{1, 2, 3}.

Excessive daylighting leads to direct glare from sunlight and indirect glare from reflective surfaces such as computer screens, and is known to increase risk of Computer Vision Syndrome as these conditions cause excessive visual demands and thereby eye fatigue and tension headaches⁴.

Electrochromic windows, by tinting when sun penetration is harshest, can reduce glare conditions resulting in greater visual comfort. The results of this study revealed that office workers in environments with View Smart Glass experienced **51% reduced eyestrain** compared to workers in environments with conventional windows.

Headache

In addition to visual discomfort, headache is another symptom that has been linked to workplace lighting conditions. It has been demonstrated that of all visual stressors, glare is the most significant cause of headaches, and workers who report less frequent glare conditions also report significantly fewer work-related headaches. Furthermore, it is well-known in clinical settings that light sensitivity is a common trigger for those who suffer from migraines^{5, 6}.

1 American Optometric Association. Computer Vision Syndrome. 2018.

2 Brody, JE. “Computer Vision Syndrome Affects Millions”. 2016. The New York Times.

3 Blehm, C., Vishnu, S., Khattak, A., Mitra, S., and Yee, R.W. Computer vision syndrome: A review. *Survey of Ophthalmology*. 2005. 50(3), 253-262.

4 Rostron, J. Sick Building Syndrome: Concepts, Issues, and Practice. 1997. E&FN Spon.

5 Robertson AS, et al. (1989). Building Sickness: Are Symptoms Related to the Office Lighting? *The Annals of Occupational Hygiene*. 33(1):47-59.

6 Hay, K.M., et al. 1044 Women with Migraine: The Effect of Environmental Stimuli. *Headache: The Journal of Head and Face Pain*. 1994. 34(3): 166-168.

63%
Fewer Headaches

56%
Less Drowsiness

51%
Reduced Eyestrain

The results of this study revealed that office workers in environments with View Smart Glass experienced **63% fewer headaches** compared to workers in environments with conventional windows.

Drowsiness

Natural light exposure is critical for a balanced circadian rhythm. A lack of exposure to daylight during the day, and particularly, a lack of blue light exposure in the morning hours, has been shown to lead to an out-of-balance circadian rhythm, which can lead to lower sleep quality at night and drowsiness and fatigue during the workday⁷. In addition, indoor environments that are too warm have been shown to increase feelings of fatigue⁸.

Electrochromic glass windows, by optimizing daylight penetration based on the time of day and conditions, and by improving thermal comfort especially for workers seated by the windows, can reduce symptoms of workplace drowsiness and fatigue. The results of this study revealed that office workers in environments with View Smart Glass reported **56% less drowsiness** compared to employees in offices with conventional windows and blinds.

Daylight Satisfaction

The study also revealed that workers in offices with intelligently optimized windows reported approximately **80% higher perceived daylight quality** in terms of color and brightness. In addition, the study found that in offices with View Smart Glass, workers were three times more likely to be sitting within 10 feet of the windows; considering that close proximity to the windows typically results in harsher glare conditions and greater thermal discomfort, the reduction in physical health symptoms reported by these employees is particularly remarkable.

Implications on Work Performance

By improving visual comfort and reducing symptoms of headaches, optimized daylight can allow employees to come into work happier and healthier and work comfortably for longer. In addition, the impacts of improved light and temperature in the workplace on employee alertness and energy can lead to improved productivity and motivation among the workforce.

7 Boubekri M, et al. Impact of Windows and Daylight Exposure on Overall Health and Sleep Quality of Office Workers: A Case-Control Pilot Study. *Journal of Clinical Sleep Medicine*. 2014. 10(6):603-611

8 Lan L, P. et al. Effects of Thermal Discomfort in an Office on Perceived Air Quality, SBS Symptoms, Physiological Responses, and Human Performance. *Indoor Air*. 2011. 21(5): 376–90.

Conclusions

A comparison of office workers revealed significantly fewer reports of eyestrain, headache, and drowsiness among those who worked in offices with View Smart Glass compared to those working in spaces fitted with conventional windows.

The Daylight & The Workplace research study emphasizes the importance of office daylighting and thermal conditions on unlocking significant benefits for employee health and wellness, factors that ultimately affect employee happiness and performance. Optimizing for these conditions can help foster a healthy, happy – and thereby successful – workforce.