



WELL LIVING LAB RESEARCH: STUDY 1

The effects of sound, light and temperature on employees in an open office environment

When people say they had a bad day in the office, they often talk about a stressful deadline, annoying co-workers, an overbearing boss or company politics. But what if the physical environment of your office impacted how you felt as well? In a proof-of-concept study, researchers at the Well Living Lab set out to quantify whether the environment alone could have a substantial impact on the experience of office workers in an open office environment. The researchers identified the impact lighting, sound, and temperature had on office workers' experience both in the office and after they left at the end of the work day.

- **8 office workers** relocated to a simulated office space at the Well Living Lab. The space was configured to match their existing office while allowing researchers to unobtrusively alter/monitor the environment.
- **6 scenes**, or combinations of environmental conditions for offices, ranged from optimal to suboptimal as determined by the scientific literature and established building standards. The employees in the study were free to move around and work as they normally would.
- **18-week study**
- **Once per day and week** the participants completed surveys to reflect on their experience in the office.
- **Three times during the study** the participants were interviewed about their experience.



ABOUT THE WELL LIVING LAB

The Well Living Lab, a collaboration of Delos™ and Mayo Clinic, is dedicated to identifying how indoor environments impact human health and well-being. It conducts scientific research with human subjects in a simulated real-world environment and shares practical findings that can be applied to improving indoor spaces where people spent approximately 90 percent of their time. The lab has 5,500 square-feet of sensor rich, reconfigurable space in downtown Rochester, Minnesota.

Learn more at
[WellLivingLab.com](https://www.WellLivingLab.com)

WELL LIVING LAB RESEARCH: STUDY 1

THE EFFECTS OF SOUND, LIGHT AND TEMPERATURE ON EMPLOYEES IN AN OPEN OFFICE ENVIRONMENT

Unsurprisingly, the combination of cold temperatures, noise, and lack of window views and natural light caused employees the most distress. People felt unhappier overall and reported being less productive and satisfied. Employees were most sensitive to cold temperatures, followed by noisy conditions and a lack of natural light. Dissatisfaction with one aspect of their environment negatively impacted how participants felt about other aspects of the environment. Employees even reported feeling dissatisfied by elements that were not manipulated in the suboptimal conditions, such as the air quality in the office.

- When employees were in uncomfortable conditions, **they reported feeling unhappy and less energetic** at work and away from work.
- Being cold made it particularly difficult to get work done. **Cold temperatures were more noticeable and unpleasant** to office workers than being too hot.
- When employees had no access to natural daylight and were unable to look out a window, their moods at work were negatively affected. Conversely, **being able to see outside improved mood**.
- As expected, noise was distracting to participants. **Sounds of other people talking and telephones ringing were particularly distracting**.
- The most favorable conditions for employees were when the thermostat was set to **21.7C/71F with limited distracting sounds** such as people talking and no white noise. In addition, having access to both natural light and a view from windows, the ability to control the window shades, and neutral to warm electric lighting were all preferred by the employees in the study.
- Employees reported that when the office area had **blue-enriched electric lighting**, they slept better at night.

The Well Living Lab is currently following up on this study by investigating the impact of electric lighting, natural light, and access to views in further studies. Future studies also will include larger sample sizes to better generalize findings to the whole population.

		ENVIRONMENTAL COMBINATIONS					
ELEMENTS	TEMPERATURE	21.7C/ 71F. Cool neutral	21.7C/71F. Cool neutral	19.4C/67 F. Cold	23.9C/75F. Neutral warm	19/4C/67F. Cold	23.9C/75F. Neutral warm
	LIGHTING	Clear glass windows with window shade control; warm-neutral white color overhead LEDs	Tinted windows with window shade control; cool-neutral color overhead LEDs	Windows covered with unmovable blackout shades; warm color overhead LEDs	Clear glass windows with window shade control; warm color overhead LEDs	Windows covered with unmovable blackout shades; cool white color overhead LEDs	Tinted windows with window shade control; cool white color overhead LEDs
	SOUND	No piped in audio	No piped in audio	Low volume white noise	Simulated speaking played over ceiling speakers.	High volume white noise	Simulated speaking played over ceiling speakers.
		FINDINGS					
EMPLOYEE REACTIONS	OVERALL	Satisfied	Satisfied	Dissatisfied. Very difficult to get work done. Negative moods and unhappy. Marginally less energy after work.	Less satisfied. Harder to work.	Dissatisfied. Very difficult to get work done. Negative moods and unhappy. Distracted. Marginally easier to sleep at night.	Less satisfied. Harder to work. Easier to sleep at night.
	TEMPERATURE	Satisfied	Less satisfied	Very uncomfortable	Warm but not terrible	Very uncomfortable	Warm but not terrible
	LIGHTING	Satisfied	Satisfied	Obtrusive	Satisfied	Obtrusive	Satisfied
	SOUND	Not distracting	Not distracting	Not bothersome	Highest level of distraction, made it hard to get work done	Highly distracting made it hard to get work done	Highest level of distraction, made it hard to get work done
	AIR	Satisfied	Satisfied	Less satisfied	Satisfied	Less satisfied	Less satisfied