



## CBE Publications & Report List October 2021

*Papers that summarize research by CBE and affiliated institutions have appeared in the following journals, trade magazines, and conference proceedings. Many of these publications are also available from the eScholarship Repository, on-line at [http://escholarship.org/uc/cedr\\_cbe](http://escholarship.org/uc/cedr_cbe).*

### 2021

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Kent, M., T. Parkinson, J. Kim, and S. Schiavon. 2021. A data-driven analysis of occupant workspace dissatisfaction. *Building and Environment*, Volume 205. November.

<https://doi.org/10.1016/j.buildenv.2021.108270> <https://escholarship.org/uc/item/9r901701>

**NEW**

Miller, D., P. Raftery, M. Nakajima, S. Salo, L. Graham, T. Peffer, M. Delgado, H. Zhang, G. Brager, D. Douglass-Jaimes, G. Paliaga, S. Cohn, M. Greene, and A. Brooks. 2021. Cooling energy savings and occupant feedback in a two year retrofit evaluation of 99 automated ceiling fans staged with air conditioning. *Energy and Buildings*, Volume 251. August.

<https://doi.org/10.1016/j.enbuild.2021.111319> <https://escholarship.org/uc/item/7752j100> **NEW**

Porras-Salazar, JA., S. Schiavon, P. Wargocki, T. Cheung, and KW. Tham. 2021. Meta-analysis of 35 studies examining the effect of indoor temperature on office work performance. *Building and Environment*, Volume 203. June. Open Access. <https://doi.org/10.1016/j.buildenv.2021.108037>

**NEW**

Tran, P., M. Adam, KW. Tham, S. Schiavon, J. Pantelic, P. Linden, E. Sofianopoulou, C. Sekhar, D. Cheong, and R. Balasubramanian. 2021. Assessment and mitigation of personal exposure to particulate air pollution in cities: An exploratory study. *Sustainable Cities and Society*, Volume 72. May.

<https://doi.org/10.1016/j.scs.2021.103052> <https://escholarship.org/uc/item/3tm9n180> **NEW**

Mishra, A.K., S. Schiavon, P. Wargocki, and K. Wai Tham. 2021. Respiratory performance of humans exposed to moderate levels of carbon dioxide. *Indoor Air*. May.

<https://doi.org/10.1111/ina.12823> <https://escholarship.org/uc/item/8qj5v8d1> **NEW**

Luo, M., H. Zhang, P. Raftery, L. Zhou, T. Parkinson, E. Arens, Y. He, and E. Present. 2021. Detailed measured air speed distribution in four commercial buildings with ceiling fans. *Building and Environment*, Volume 200, ISSN 0360-1323. May.

<https://doi.org/10.1016/j.buildenv.2021.107979> <https://escholarship.org/uc/item/3ts5528s>

**NEW**

Parkinson, T., H. Zhang, E. Arens, Y. He, R. de Dear, J. Elson, A. Parkinson, C. Maranville, and A. Wang. 2021. Predicting thermal pleasure experienced in dynamic environments from simulated cutaneous thermoreceptor activity. *Indoor Air*. May.

<https://doi.org/10.1111/ina.12859> <https://escholarship.org/uc/item/1xd8n2t0> **NEW**

Xu, Y., P. Raftery, and S. Schiavon. 2021. Capturing energy savings from correcting VAV box minimums on campus. Masters of Science Thesis. Department of Architecture, University of California, Berkeley. May. <https://escholarship.org/uc/item/6zt4k0hd> **NEW**

Graham, L., T. Parkinson, and S. Schiavon. 2021. Lessons learned from 20 years of CBE's occupant surveys. *Building and Cities*, Volume 2, Issue 1, pages 166-184. February.

<https://doi.org/10.5334/bc.76>

Dawe, M., C. Karmann, S. Schiavon, and F. Bauman. 2021. Field evaluation of thermal and acoustical comfort in eight North-American buildings using embedded radiant systems. Submitted for publication in *PLOS ONE*. <https://escholarship.org/uc/item/24k6q5zg>

## **2020**

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Tartarini, F., S. Schiavon, T. Cheung, and T. Hoyt. 2020. CBE thermal comfort tool: Online tool for thermal comfort calculations and visualizations. *SoftwareX*, 12:100563.

<https://doi.org/10.1016/j.softx.2020.100563>

Tartarini, F. and S. Schiavon. 2020. Pythermalcomfort: A python package for thermal comfort research. *SoftwareX*, 12:100578. <https://doi.org/10.1016/j.softx.2020.100578>

Gall, E., A. Mishra, J. Li, S. Schiavon, and A. Lauguerre. 2020. Impact of cognitive tasks on co2 and isoprene emissions from humans. *Environmental Science & Technology*, Volume 55, Pages 139-148. December. <https://doi.org/10.1021/acs.est.0c03850>

[https://pdxscholar.library.pdx.edu/mengin\\_fac/324/](https://pdxscholar.library.pdx.edu/mengin_fac/324/)

Lassen, N., F. Goia, S. Schiavon, and J. Pantelic. 2020. Field investigations of a smiley-face polling station for recording occupant satisfaction with indoor climate. *Building and Environment*. Volume 185. November. <https://doi.org/10.1016/j.buildenv.2020.107266>

<https://doi.org/10.1016/j.buildenv.2020.107266>

He, Y., E. Arens, N. Li, Z. Wang, H. Zhang, Y. A, and C. Yuan. 2020. Modeling solar radiation on a human body indoors by a novel mathematical model. *Building and Environment*, Volume 187. November. <https://doi.org/10.1016/j.buildenv.2020.107421>

<https://doi.org/10.1016/j.buildenv.2020.107421>

<https://escholarship.org/uc/item/78f0b543>

Tartarini, F. and S. Schiavon. 2020. Skin temperature sampling period for longitudinal thermal comfort studies. *Proceedings of the Indoor Air 2020*. November.

<https://escholarship.org/uc/item/9jn57924>

Cheung, T., S. Schiavon, L. Graham, and K. Tham. 2020. Occupant satisfaction with the indoor environment in seven commercial buildings in Singapore. *Building and Environment*. November. <https://doi.org/10.1016/j.buildenv.2020.107443> <https://escholarship.org/uc/item/43k2z2zx>

Ko, W., M. Kent, S. Schiavon, B. Levitt, and G. Betti. 2020. A window view quality assessment framework. *CBE Report*. October. <https://escholarship.org/uc/item/5ft4f88r> **NEW**

Duarte Roa, C., S. Schiavon, and T. Parkinson. 2020. Targeted occupant surveys: A novel method to effectively relate occupant feedback with environmental conditions. *Building and Environment*, Volume 184. October. <https://doi.org/10.1016/j.buildenv.2020.107129> <https://escholarship.org/uc/item/9sj1c34p>

He, Y., N. Li, H. Zhang, Y. Han, J. Lu, and L. Zhou. 2020. Air-conditioning use behaviors when elevated air movement is available. *Energy and Buildings*, Volume 225. October. <https://doi.org/10.1016/j.enbuild.2020.110370> <http://escholarship.org/uc/item/9np5x6cv>

Li, P., T. Parkinson, S. Schiavon, T. Froese, R. de Dear, A. Rysanek, and S. Staub-French. 2020. Improved long-term thermal comfort indices for continuous monitoring. *Energy and Buildings*, Volume 224. October. <https://doi.org/10.1016/j.enbuild.2020.110270> <https://escholarship.org/uc/item/9h55w20w>

Quintana, M., S. Schiavon, K.W. Tham, and M. Clayton. 2020. Balancing thermal comfort datasets: We GAN but should we? *Proceedings of the ACM BuildSys '20 Conference*, Yokohama, Japan. September. <http://arxiv.org/abs/2009.13154v1>

Kent, M. and S. Schiavon. 2020. Evaluation of the effect of landscape distance seen in window views on visual satisfaction. *Building and Environment*. August. <https://doi.org/10.1016/j.buildenv.2020.107160> <https://escholarship.org/uc/item/6gd9t8pj>

Lehrer, D., E. Arens, H. Zhang, and D. Fannon. 2020. Prototyping solutions to improve comfort and enable HVAC energy savings. *Proceedings, ACEEE 2020 Summer Study on Energy Efficiency in Buildings*. August. <https://escholarship.org/uc/item/0h64g14s>

Altomonte, S., J. Allen, P. Bluysen, G. Brager, L. Hescong, A. Loder, S. Schiavon, J. Veitch, L. Wang, and P. Wargocki. 2020. Ten questions concerning well-being in the built environment. *Building and Environment*, 180: 106949. August. <https://doi.org/10.1016/j.buildenv.2020.106949>

Liu, S., Z. Wang, S. Schiavon, Y. He, M. Luo, H. Zhang, and E. Arens. 2020. Predicted percentage dissatisfied with vertical temperature gradient. *Energy and Buildings*, 220. August. <https://doi.org/10.1016/j.enbuild.2020.110085> <https://escholarship.org/uc/item/0s76t57k>

Duarte Roa, C. 2020. Design and control of high thermal mass radiant systems. Doctor of Philosophy Dissertation. Dept. of Architecture, University of California, Berkeley <https://escholarship.org/uc/item/82t6n3xr>

Kent, M., T. Cheung, J. Li, and S. Schiavon. 2020. Experimental evaluation of visual flicker caused by ceiling fans. *Building and Environment*. Volume 182, Pages 1-14. July.

<https://doi.org/10.1016/j.buildenv.2020.107060> <https://escholarship.org/uc/item/3wj1f6xj>

Rafsanjani, H. N., A. Ghahramani, A. H. Nabizadeh. 2020. iSEA: IoT-based smartphone energy assistant for prompting energy-aware behaviors in commercial buildings. *Applied Energy*, 266.

May. <https://escholarship.org/uc/item/34w088fp> <https://doi.org/10.1016/j.apenergy.2020.114892>

Ko, W., S. Schiavon, H. Zhang, L. Graham, G. Brager, I. Mauss, and Y. Lin. 2020. The impact of a view from a window on thermal comfort, emotion, and cognitive performance. *Building and Environment*. May.

<https://doi.org/10.1016/j.buildenv.2020.106779>

<https://escholarship.org/uc/item/09b861jb>

Lipczynska, A., A. Mishra, and S. Schiavon. 2020. Experimental evaluation of the effect of body mass on thermal comfort perception. *11th Windsor Conference on Thermal Comfort*, pages 403-415. May.

<https://escholarship.org/uc/item/2hf4r1pg>

Li, J., M. Wan, S. Schiavon, K. Tham, S. Zuraimi, J. Xiong, M. Fang, and E. Gall. 2020. Size-resolved dynamics of indoor and outdoor fluorescent biological aerosol particles in a bedroom: A one-month case study in singapore. *Indoor Air*, Volume 30, Issue 5, Pages 942-954. April.

<http://doi.org/10.1111/ina.12678> <https://escholarship.org/uc/item/6rh0c245>

Raftery, P., D. Miller, H. Zhang, T. Pepper, G. Brager, L.T. Graham, E. Present, E. Arens, D. Douglas-Jaimes, G. Paliaga, A. Brooks, S. Cohn, and M. Greene. 2020. Integrating Smart Ceiling Fans and Communicating Thermostats to Provide Energy-Efficient Comfort. Final report to California Energy Commission. April.

<https://escholarship.org/uc/item/91z0m3xw>

Ghahramani, A., P. Galicia, D. Lehrer, Z. Varghese, Z. Wang, and Y. Pandit. 2020. Artificial Intelligence for Efficient Thermal Comfort Systems: Requirements, Current Applications and Future Directions. *Frontiers in Built Environment*. April.

<https://doi.org/10.3389/fbuil.2020.00049>

<https://escholarship.org/uc/item/75j1m967>

Arens, E., D. Heinzerling, S. Liu, G. Paliaga, A. Pande, S. Schiavon, Y. Zhai, and H. Zhang. 2020. Advances to ASHRAE Standard 55 to encourage more effective building practice. Proceedings of Windsor Conference 2020: Resilient Comfort, London, April 13-16.

<https://escholarship.org/uc/item/5ww2c38p>

Schweiker, M., A. André, F. Al-Atrash, H. Al-Khatri, R.R. Alprianti, H. Alsaad, R. Amin, et al. 2020. Evaluating assumptions of scales for subjective assessment of thermal environments – Do laypersons perceive them the way, we researchers believe? *Energy and Buildings*, 211: 109761.

March. <https://doi.org/10.1016/j.enbuild.2020.109761>

Raftery, P., and D. Douglass-Jaimes. 2020. Ceiling Fan Design Guide. CBE Report. March.

<https://escholarship.org/uc/item/6s44510d>

- Arens, E., A. Ghahramani, R. Przybyla, M. Andersen, S. Min, T. Peffer, P. Raftery, M. Zhu, V. Luu, and H. Zhang. 2020. Measuring 3D indoor air velocity via an inexpensive low-power ultrasonic anemometer. *Energy and Buildings*, 211. March. <https://doi.org/10.1016/j.enbuild.2020.109805>  
<https://escholarship.org/uc/item/43c525tg>
- Chen, W., H. Zhang, E. Arens, M. Luo, Z. Wang, L. Jin, J. Liu, F. Bauman, and P. Raftery. 2020. Ceiling-fan-integrated air conditioning: airflow and temperature characteristics of a sidewall-supply jet interacting with a ceiling fan. *Building and Environment*, Volume 171. March. <https://doi.org/10.1016/j.buildenv.2020.106660> <https://escholarship.org/uc/item/8cj7n6ps>
- Parkinson, T., P. Raftery, and E. Present. 2020. Spatial uniformity of thermal comfort from ceiling fans blowing upwards. *Proceedings of ASHRAE Winter Conference*. February. <https://escholarship.org/uc/item/5fs9q6fq>
- Kent, M., S. Schiavon, and J. Jakubiec. 2020. A dimensionality reduction method to select the most representative daylight illuminance distributions. *Journal of Building Performance Simulation*, Volume 13, Issue 1. January. <https://doi.org/10.1080/19401493.2019.1711456>  
<https://escholarship.org/uc/item/04x6v86j>
- Parkinson, T., R. de Dear, and G. Brager. 2020. Nudging the adaptive thermal comfort model. *Energy and Buildings*, Vol 206. January. <https://doi.org/10.1016/j.enbuild.2019.109559>  
<https://escholarship.org/uc/item/0080620p>
- Fierro, G., M. Pritoni, M. AbdelBaky, P. Raftery, T. Peffer, G. Thomson, and D. Culler. 2020. Mortar: An open testbed for portable building analytics (journal extension). *ACM Transactions on Sensor Networks*. January. <https://doi.org/10.1145/3366375>
- Rafsanjani, H., and A. Ghahramani. 2020. Towards utilizing internet of things (IoT) devices for understanding individual occupants' energy usage of personal and shared appliances in office buildings. *Journal of Building Engineering*, Vol. 27. January. <https://doi.org/10.1016/j.jobe.2019.100948> <https://escholarship.org/uc/item/07v2s2xm>
- Wang, Z., K. Warren, M. Luo, X. He, H. Zhang, E. Arens, W. Chen, Y. He, Y. Hu, L. Jin, S. Liu, D. Cohen-Tanugi, and M. Smith. 2020. Evaluating the comfort of thermally dynamic wearable devices. *Energy and Buildings*, Vol. 167. January. <https://doi.org/10.1016/j.buildenv.2019.106443>  
<https://escholarship.org/uc/item/7rf7z7k1>
- Luo, M., Z. Wang, H. Zhang, E. Arens, D. Filingeri, L. Jin, A. Ghahramani, W. Chen, Y. He, and B. Si. 2020. High-density thermal sensitivity maps of the human body. *Building and Environment*, Vol 167. January. <https://doi.org/10.1016/j.buildenv.2019.106435>  
<https://escholarship.org/uc/item/3kq5p62q>
- Zhai, Y.C., S. Zhao, Y. Gao, W. Song, L. Yang, H. Zhang, and E. Arens. 2020. Preferred temperatures with and without air movement during moderate exercise. *Energy and Buildings*, Volume 207, 109565, ISSN 0378-7788. January. <https://doi.org/10.1016/j.enbuild.2019.109565>

2019

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Schweiker, M., et al 95 authors. 2019. The Scales Project, a Cross-National Dataset on the Interpretation of Thermal Perception Scales. *Scientific Data*, 6 (1): 1–10. November.

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Zhai, Y., F. Miao, L. Yang, S. Zhao, H. Zhang, and E. Arens. 2019. Using personally controlled air movement to improve comfort after simulated summer commute. *Building and Environment*, Vol. 165. November.

<https://doi.org/10.1016/j.buildenv.2019.106329>

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Yang, B., A. Melikov, A. Kabanshi, C. Zhang, F. Bauman, G. Cao, H. Awbi, H. Wigo, J. Niu, K. Cheong, K. Tham, M. Sandberg, P. Nielsen, R. Kosonen, R. Yao, S. Kato, S. Sekhar, S. Schiavon, T. Karimipannah, X. Li, and Z. Lin. 2019. A review of advanced air distribution methods- theory, practice, limitations, and solutions. *Energy and Buildings*, Vol. 202. November.

<https://doi.org/10.1016/j.enbuild.2019.109359> <https://escholarship.org/uc/item/85x6r3ww>

Zhai Y., A. Honnekeri, M. Pigman, M. Fountain, H. Zhang, X. Zhou, and E. Arens. 2019. Use of adaptive control and its effects on human comfort in a naturally ventilated office in Alameda, California. *Energy and Buildings*, Vol. 203, 13 pp. November.

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Rafsanjani, H., and A. Ghahramani. 2019. Extracting occupants' energy-use patterns from wi-fi networks in office buildings. *Journal of Building Engineering*. November.

<https://doi.org/10.1016/j.jobbe.2019.100864> <https://escholarship.org/uc/item/4db8s3nr>

Pantelic, J., M. Dawe, and D. Licina. 2019. Use of IoT sensing and occupant surveys for determining the resilience of buildings to forest fire generated pm2.5. *PLOS ONE*. October.

<https://doi.org/10.1371/journal.pone.0223136>

Woolley, J., S. Schiavon, F. Bauman, and P. Raftery. 2019. Side-by-side laboratory comparison of radiant and all-air cooling: how natural ventilation cooling and heat gain characteristics impact space heat extraction rates and daily thermal energy use. *Energy and Buildings*, Vol 200.

October. <https://doi:10.1016/j.enbuild.2019.07.020> <https://escholarship.org/uc/item/4w94k709>

Aijazi, A., R. Best, and S. Schiavon. 2019. Optimizing energy conservation measures in a grocery store using present and future weather files. *Proceedings of the International Building Performance Simulation Association*, Volume 16. September.

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Pantelic, J., S. Liu, L. Pistore, D. Licina, M. Vannucci, S. Sadrizadeh, A. Ghahramani, B. Gilligan, E. Sternberg, K. Kampschroer, and S. Schiavon. 2019. Personal CO<sub>2</sub> cloud: Laboratory measurements of metabolic CO<sub>2</sub> inhalation zone concentration and dispersion in a typical office desk setting. *Journal of Exposure Science & Environmental Epidemiology*, 1–10. August.

<https://doi.org/10.1038/s41370-019-0179-5>

- Pei, G., D. Rim, S. Schiavon, and M. Vannucci. 2019. Effect of sensor position on the performance of CO<sub>2</sub>-based demand control ventilation. *Energy and Buildings*. August. <https://doi.org/10.1016/j.enbuild.2019.109358> <http://escholarship.org/uc/item/8n23p8c4>
- Liu, S., S. Schiavon, H. Das, M. Jin, and C. Spanos. 2019. Personal thermal comfort models with wearable sensors. *Building and Environment*. August. <https://doi.org/10.1016/j.buildenv.2019.106281> <https://escholarship.org/uc/item/3fb0p5gk>
- Wang, Z., H. Yu, M. Luo, Z. Wang, H. Zhang, and Y. Jiao. 2019. Predicting older people's thermal sensation in building environment through a machine learning approach: Modelling, interpretation, and application. *Building and Environment*. August. <https://doi.org/10.1016/j.buildenv.2019.106231> <https://escholarship.org/uc/item/9wq674bp>
- Ghahramani, A., M. Zhu, R. Przybyla, M. Andersen, P. Galicia, T. Peffer, H. Zhang, and E. Arens. 2019. Measuring air speed with a low-power MEMS ultrasonic anemometer via adaptive phase tracking. *IEEE Sensors Journal*, 1-10. June. <http://dx.doi.org/10.1109/JSEN.2019.2920648> <https://escholarship.org/uc/item/8kf1c11k>
- Dawe, M. 2019. Field evaluation of occupant satisfaction and energy performance in eight LEED-certified buildings using radiant systems. Master of Science Thesis. Dept. of Architecture, University of California, Berkeley. June. <https://escholarship.org/uc/item/6d95z6sw>
- Dawe, M., P. Raftery, J. Woolley, S. Schiavon, and F. Bauman. 2019. Comparison of mean radiant and air temperatures in mechanically-conditioned commercial buildings from over 200,000 field and laboratory measurements. Submitted to *Energy and Buildings*. June. <https://doi.org/10.1016/j.enbuild.2019.109582> <https://escholarship.org/uc/item/2sn4v9xr>
- Zhai, Y., S. Zhao, L. Yang, N. Wei, Q. Xu, H. Zhang, and E. Arens. 2019. Transient human thermophysiological and comfort responses indoors after simulated summer commutes. *Building and Environment*, Vol. 157. June. <https://doi.org/10.1016/j.buildenv.2019.04.023> <https://escholarship.org/uc/item/9z94n7mg>
- Raftery, P., J. Fizer, W. Chen, Y. He, H. Zhang, E. Arens, S. Schiavon, and G. Paliaga. 2019. Ceiling fans: Predicting indoor air speeds based on full laboratory measurements. *Building and Environment* 155, 210-223. May. <https://doi.org/10.1016/j.buildenv.2019.03.040> <https://escholarship.org/uc/item/4p479663>
- Soebarto, V., H. Zhang, and S. Schiavon. 2019. A thermal comfort environmental chamber study of older and younger people. *Building and Environment* 155, 1-14. May. <https://doi.org/10.1016/j.buildenv.2019.03.032> <https://escholarship.org/uc/item/00h9x985>
- Arens, E. and H. Zhang. U.S. Patent No. 10,279,646, Issued on May 7, 2019: "Ventilated Seatbelt for Efficient Cooling and Heating of Vehicle Passengers". Application No.: 15/133,425, Filing Date: October 10, 2014. UC Berkeley Case No.: BK-2010-079-2.

Bauman, F., P. Raftery, S. Schiavon, C. Karmann, J. Pantelic, C. Duarte, J. Woolley, M. Dawe, L.T. Graham, D. Miller, H. Cheng, J. Feng, D. Heinzerling, C. Higgins, K. Carbonnier, G. Paliaga, A. Pande, and F. Farahmand. 2019. Optimizing Radiant Systems for Energy Efficiency and Comfort. Final report to the California Energy Commission. April.

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He, Y., W. Chen, Z. Wang, and H. Zhang. 2019. Review of fan-use rates in field studies and their effects on thermal comfort, energy conservation, and human productivity. *Energy and Buildings*, vol. 194. April. <https://doi.org/10.1016/j.enbuild.2019.04.015>

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Zani, A., H. D. Richardson, A. Tono, S. Schiavon, and E. Arens. 2019. A simulation-based design analysis for the assessment of indoor comfort under the effect of solar radiation. Symposium on Simulation for Architecture and Urban Design, Georgia Tech, Atlanta, USA, April 7th-9th.

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Cheung, T., S. Schiavon, T. Parkinson, P. Li, and G. Brager. 2019. Analysis of the accuracy on PMV – PPD model using the ASHRAE Global Thermal Comfort Database II. *Building and Environment*. April. <https://doi.org/10.1016/j.buildenv.2019.01.055>

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Kent, M. G., S. A. Fotios, and C. T. Cheung. 2019. Stimulus range bias leads to different settings when using luminance adjustment to evaluate discomfort due to glare. *Building and Environment* 153, 281-287. April. <https://doi.org/10.1016/j.buildenv.2018.12.061>

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Li, P., T. Parkinson, G. Brager, S. Schiavon, T. C. T. Cheung, and T. Froese. 2019. A data-driven approach to defining acceptable temperature ranges in buildings. *Building and Environment*. April. <https://escholarship.org/uc/item/4qm4c7bk>

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Zhou, X., Y. Liu, M. Luo, L. Zhang, Q. Zhang, and X. Zhang. 2019. Thermal comfort under radiant asymmetries of floor cooling system in 2 h and 8 h exposure durations. *Energy and Buildings* 188-189, 98-110. April. <https://doi.org/10.1016/j.enbuild.2019.02.009>

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