

8-10-2020

## Indicators of Sleepiness using Eye-Tracking

Debasis Roy

*Missouri University of Science and Technology, dr4b8@mst.edu*

Fiona Nah

*Missouri U of Science and Technology, nahf@mst.edu*

Matthew Thimgan

*Missouri University of Science and Technology, thimgan@mst.edu*

Follow this and additional works at: [https://aisel.aisnet.org/treos\\_amcis2020](https://aisel.aisnet.org/treos_amcis2020)

---

### Recommended Citation

Roy, Debasis; Nah, Fiona; and Thimgan, Matthew, "Indicators of Sleepiness using Eye-Tracking" (2020).  
*AMCIS 2020 TREOs*. 84.

[https://aisel.aisnet.org/treos\\_amcis2020/84](https://aisel.aisnet.org/treos_amcis2020/84)

This material is brought to you by the TREO Papers at AIS Electronic Library (AISeL). It has been accepted for inclusion in AMCIS 2020 TREOs by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact [elibrary@aisnet.org](mailto:elibrary@aisnet.org).

# Indicators of Sleepiness using Eye-Tracking

TREO Talk Paper

**Debasis Roy**

Missouri University of Science and  
Technology  
dr4b8@mst.edu

**Fiona Fui-Hoon Nah**

Missouri University of Science and  
Technology  
nahf@mst.edu

**Matthew Thimgan**

Missouri University of Science and Technology  
thimgan@mst.edu

## Abstract

The Centers for Disease Control and Prevention (CDC) has declared sleep deprivation (SD) a public health epidemic<sup>1</sup>. SD can create hazards in the workplace, which include safety hazards and psychosocial hazards (i.e., mental health and well-being) (Stephanidis et al., 2019). Hence, it is critical to detect sleepiness in the workplace in order to take corrective actions to minimize or prevent such hazards. In this research, we are interested to utilize eye-tracking to detect sleepiness of users of computer-based systems. We review the literature on the biological explanations of SD and eye-tracking metrics associated with sleepiness (Roy et al., 2000). Our literature review suggests that saccadic eye movements (Fransson et al., 2000; Zils et al., 2005), eye blinks (Caffier et al., 2003), as well as pupil size and constrictions (Franzen et al., 2009; Russo et al., 2003; Wilhelm et al., 1998) can be used to detect sleepiness. We plan to conduct an experiment to assess and validate these metrics among users of computer-based systems. Our findings will be helpful for detecting sleepiness of users in a computer-based environment.

## References

- Caffier, P. P., Erdmann, U., & Ullsperger, P. (2003). "Experimental Evaluation of Eye-blink Parameters as a Drowsiness Measure," *European Journal of Applied Physiology* (89:3-4), pp. 319-325.
- Fransson, P. A., Patel, M., Magnusson, M., Berg, S., Almladh, P., & Gomez, S. (2008). "Effects of 24-hour and 36-hour Sleep Deprivation on Smooth Pursuit and Saccadic Eye Movements," *Journal of Vestibular Research* (18:4), pp. 209-222.
- Franzen, P. L., Buysse, D. J., Dahl, R. E., Thompson, W., & Siegle, G. J. (2009). "Sleep Deprivation Alters Pupillary Reactivity to Emotional Stimuli in Healthy Young Adults," *Biological Psychology* (80:3), pp. 300-305.
- Roy, D., Nah, F., & Thimgan, M. (2000). "A Review on Eye-tracking Metrics for Sleepiness," in *Lecture Notes in Computer Science*, F. F.-H. Nah and K. Siau (editors), Springer.
- Russo, M., Thomas, M., Thorne, D., Sing, H., Redmond, D., Rowland, L., Johnson, D., Hall, S., Krichmar, J., & Balkin, T. (2003). "Oculomotor Impairment during Chronic Partial Sleep Deprivation," *Clinical Neurophysiology* (114:4), pp. 723-736.
- Stephanidis, C., Salvendy, G., Antona, M., Chen, J. Y., Dong, J., Duffy, V. G., ... & Zhou, J. (2019). "Seven HCI Grand Challenges," *International Journal of Human-Computer Interaction* (35:14), pp. 1229-1269.
- Wilhelm, B., Wilhelm, H., Lüdtke, H., Streicher, P., & Adler, M. (1998). "Pupillographic Assessment of Sleepiness in Sleep-deprived Healthy Subjects," *Sleep* (21:3), pp. 258-265.
- Zils, E., Sprenger, A., Heide, W., Born, J., & Gais, S. (2005). "Differential Effects of Sleep Deprivation on Saccadic Eye Movements," *Sleep* (28:9), pp. 1109-1115.

---

<sup>1</sup> <https://web.archive.org/web/20180101012724/https://www.cdc.gov/Features/dsSleep/>