The more protective features the glove has, the less flexible it becomes and the higher its impact on dexterity. Sturdier gloves offer the most mechanical protection but at the expense of reduced flexibility and, thus, decreased dexterity. Conversely, relatively thinner and more flexible metacarpal gloves offer lower mechanical protection but allow much more dexterous function.

Protection against injury is an important mitigation strategy against lost productivity, healthcare spending, and worker's compensation payments. However, these results suggest that employers and safety professionals should consider all aspects of a glove, its potential impact on hand function, and the task requirements when selecting gloves for worker utilization.

REFERENCES

1. Baltimore Therapeutic Equipment (BTE) Technologies, 2023. Rehabilitation equipment. Primus RS. Retrieved February 10, 2023, from: https://www.btetechnologies.co m/rehabilitation/primus/.

2. U.S. Bureau of Labor Statistics, 2021. Number of nonfatal occupational injuries and illnesses involving days away from work by nature of injury or illness and selected parts of body affected by injury or illness private industry, 2020. Retrieved February 10, 2023. https://www.bls.gov/iif/nonfatal-injuries-and-illnesses-tables/case-and-demographic-characteristics-table-r13-2020.htm.

3.Viradia, R., Annie, F., Kali, M., Pollock, F., Hayes, J., 2021. Hand injuries of coal miners in Southern West Virginia: a pilot study on health-care resources in Southern West Virginia. J. Emergencies, Trauma, Shock 14 (1), 18. https://doi.org/10.4103/JETS. JETS_39_19.

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EVACUATION ROUTE DESIGN BASED ON VISIBILITY FOR REDUCING EVACUATION DELAYS

Fire-related incidents continue to pose a significant threat to human life in spite of advancements in fire prevention technology and legislation. It is reported that almost half of the fatalities resulting from fires are caused by delayed evacuation in Ukraine. Recent incidents in which victims were unable to evacuate, in which people lost their lives. When the electrical system stopped, the doors of the train cars closed. Many victims did not know how to open the doors manually, which led to the inability to evacuate. Opening doors and locating evacuation exits is a challenge in many emergency situations. Unfortunately, this has led to tragic outcomes in some cases. [1-3]

Fig. 1 shows the evaluation structure of visual environment, which is closely connected with three factors: environmental conditions, object conditions, and human visual ability. Visual stimulus is defined by the former two factors, while visual sensitivity is defined by the latter. The evaluation of visual response, or visibility, depends on both visual stimulus and visual sensitivity. Visual stimulus is represented by four elements: size (m) or visual angle (arc minutes) of the visual target, adaptation (background) luminance (cd/m2), luminance contrast between the visual target luminance and background luminance (no units), and observation time (milliseconds).

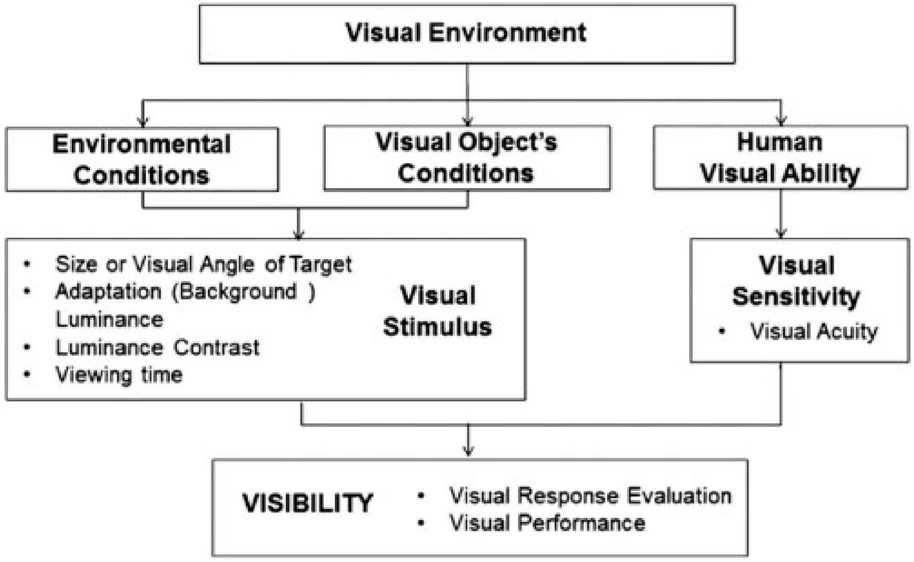

Fig. 1. Evaluation structure of visual environment

If the observation time exceeds 100 ms, the visibility stabilizes no matter of time. By analyzing the relationship between the visual stimulus and visual sensitivity, we can predict the evaluation of visual response, for instance, the visible distance of an emergency light from the evacuee's position or identification of obstacles on the escape road surface and visual performance, such as the walking speed of evacuees in an escape route, in a visual environment. Visual acuity (VA) is a common form of low vision and is commonly used as a measure of visual ability in medical examinations.

The distance between signs and an observer D (m) was calculated using the visible distance V (m) between target, i.e. characters of text information in the sign and the observer's eye, the height H (m) of the character from the floor, the eye height h (m) of the observer, the angle δ (arc degrees) of the center of the character and vertical direction of the observer's eye, and the actual size S' (m) of the character. Fig. 2 depicts the external view. To ensure that the sign's characters would be legible for many people during a disaster situation, the visibility level α′ was set at 0.8.

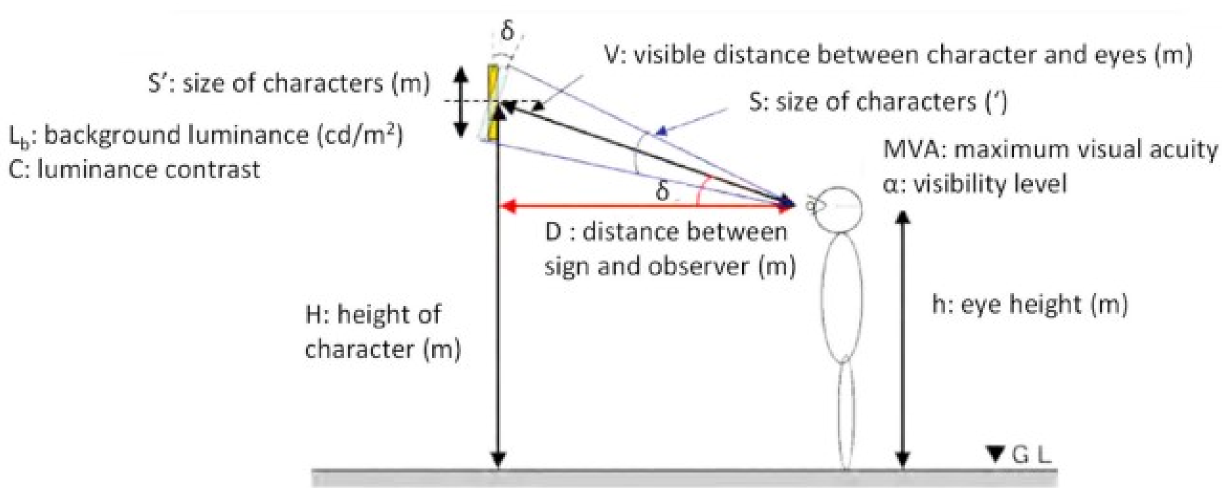

Fig. 2. Physical characteristics required for calculation of visible distance

Visibility is crucial for human behavior during a fire. Large amounts of smoke can severely limit visibility, making it difficult for evacuees to locate escape routes. This can result in unsuccessful evacuations and increase the risk of casualties. In such situations, the walking speed of evacuees decreases significantly, and it is a crucial visual performance factor. Therefore, it is essential to understand how people behave during fires with smoke and to minimize fire-related casualties. Numerous studies have been conducted on evacuation behavior during fires in large spaces like tunnels. However, most of these studies fail to describe the lighting conditions of the experimental environment.

According to ISO/CIE emergency lighting guidelines, building emergency lighting should provide more than 1.0 lx on the centerline of the evacuation route, have a uniformity ratio greater than 1/40 between the minimum and maximum illuminance, and have an average color rendering index (Ra). This value should be considered the lower limit of the standard, and the sufficient light should be provided in evacuation routes to eliminate any sense of insecurity.

REFERENCES

1. T. Yamada, Y. Akizuki, Chapter 61 Visibility and Human Behavior in Fire Smoke, SFPE Handbook of Fire Protection Engineering, 2016, pp. 2181–2206.
2. Enrico Ronchi, Daniel Nilsson, et al., A virtual reality experiment on flashing lights at emergency exit portals for road tunnel evacuation, Fire Technol. 52 (2016) 623–647.
3. Silvia Arias, Axel Mossberg, Daniel Nilsson, Jonathan Wahlaqvist, A study on evacuation behavior in physical and virtual reality experiments, Fire Technol. 58 (2022) 817–849.

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COMFORT AND SLEEP QUALITY IN FULLY AUTOMATED VEHICLES

Increasingly higher levels of vehicle automation are currently being developed. With the upcoming release of fully automated vehicles, there will be plenty of new opportunities for occupants. In this context, several studies have explored alternative use cases that people wish to engage in while travelling in these vehicles, with sleeping being identified as one of the most popular priorities. Sleep is one of our fundamental daily activities. It takes up a third of our daily time; and good sleep is essential for health, well-being and quality of life. Moreover, daily performance depends highly on sleep quality. Adults are recommended to sleep seven to 9 h daily, although adults often sleep less than recommended. Short sleep durations have been often associated with poorer health. In particular, during the day after a night of poor or abnormal sleep, there are immediate negative physical and cognitive effects, such as concentration and vigilance detriments, memory blanks and irritability.

An optimal sleep environment is key to achieving good sleep quality. In a car interior, accomplishing this ideal sleeping environment is troublesome due to limited space and car movement. However, one of the opportunities in this scenario is the high level of control over the sleep environment. This includes lighting, temperature and air quality, as well as the creation of a specific car seat for the purpose of sleeping, addressing the seat angles, as it is one of the main differences between today's car seat and a bed.

The seat prototype used in the study was positioned inside of a Volkswagen T6.1 Multivan. The interior surrounding of the seat prototype was built to be a comfortable, private space, resembling that of a first-class long-distance airplane cabin. The purpose of the study was to compare the sleep achieved in two different seat positions, a reclined and a flat seat position. The reclined position at 60 ^{0} from the vertical, close to position prior described and a lying position at 87 ^{0}, resembling a flat bed angle (Fig. 2). The researchers conducted pilot tests to determine the most comfortable angles for the seat pan and leg support for each backrest position. The seat pan angles were set at 20 ^{0} and 0 ^{0} relative to the horizontal,