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.

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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, while the leg support angles were adjusted to 65 ^{0} and 90 ^{0} from the vertical, for the reclined and the flat position, respectively. Therefore, the seat could be set up in those two positions as illustrated in Fig. 1.

Previous studies suggest that foam stiffness might be one of the critical aspects when it comes to improving sleep quality. Therefore, a foam optimization process was executed by experts, considering previous studies comfort evaluation and participants' feedback comments. The result of this process was a two layered surface with different foam characteristics (Fig. 2). The under layer is made from a traditional foam of 3.9 kPa and 20 mm thickness and the over layer is made from viscoelastic foam of 1.6 kPa of 30 mm thickness.

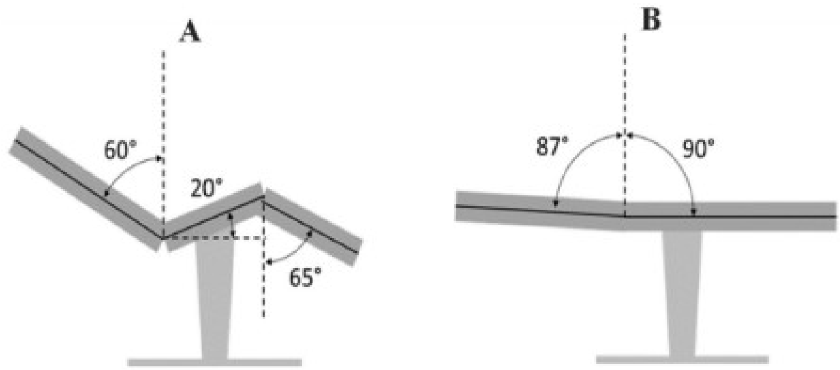

Fig. 1. Configurations for reclined and flat seat conditions. (A) Reclined (B) Flat.

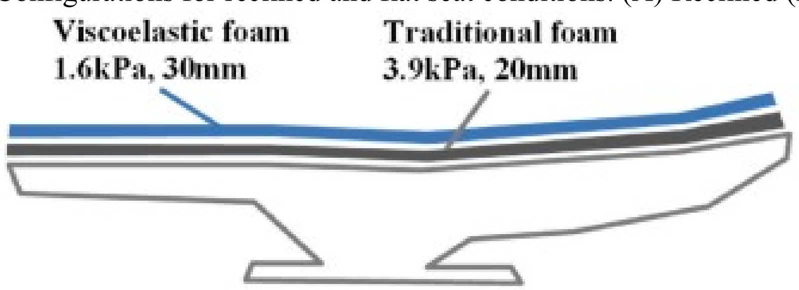

Fig. 2. Side view diagram of seat prototype in flat condition.

Blue area represents the 1.6 kPa layer of foam and grey area represents the 3.9 kPa layer of foam.

In summary, this study provides a comprehensive understanding of sleep quality and quantity in the context of travelling in a fully automated car. By using a real environment instead of a typical lab, the study provided a more realistic view of sleep in this new context. The study's multi-method approach combining subjective evaluations based on questionnaires and multimodal neurophysiological recordings evaluated with machine learning provided a holistic picture of individual comfort and sleep quality. The findings of this study fill some current knowledge gaps in the field of sleeping while travelling by car and have important implications for the development of new technologies and design of car seats. While this study represents a first step towards a better understanding of sleeping while travelling by car, future research is needed to explore the factors that influence sleep quality in vehicles and develop interventions to improve it.

In conclusion, this study has contributed to the understanding of sleep quality in vehicles and its evaluation. Sleep quality was generally within optimal sleep ranges in both seat positions, with the flat position resulting in deeper sleep and quicker sleep onset for participants. The findings suggest that the flat position may be more conducive to achieving deeper and more restful sleep. Moreover, each participant had the opportunity to sleep in both tested seat positions. The majority of participants preferred the flat position for sleeping in the travelling context. These findings may have implications for future car seat designs, suggesting that a flat position may be more conducive to sleep quality while travelling. A future where people can comfortably sleep inside a car while commuting or going on holidays might be possible with further developments in car seat designs and technology.

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A STUDY OF SMARTPHONE USE EFFECT ON GAIT PERFORMANCE WHILE WALKING UP AND DOWN STAIRS AND ESCALATORS

The increasing use of smartphones has affected the way people walk, with more people talking on their phones or looking down at them while walking. Smartphone use during walking has been reported to distract pedestrians, resulting in safety concerns. We analyzed data from the National Electronic Injury Surveillance System (NEISS) database on injuries in hospital emergency rooms from 2004 to 2010 and found an increase in the percentage of total phone-related pedestrian injuries in public places, with a higher rate of injuries among young adults. Previous studies have found that smartphone use during walking increases the reaction time to visual and auditory targets and reduces efficiency in perceiving and processing environmental stimuli. In addition, numerous studies have shown that the demand for this dual-task influences pedestrians’ gait performance; for example, they might have a slower walking speed, shorter step length, increased step width and larger head flexion.

In addition to walking on flat ground, stairs are becoming potentially hazardous areas for distracted walking associated with smartphones, with a higher fall risk and slower walking speed. Compared to walking on a horizontal surface, the workload taken over by the muscles of a single leg is greater when walking on stairs, which results in different locomotion requirements and increases the risk of falls and injuries. Extracted phone-related injury cases from the NEISS database from 2011 to 2019 and found that most injuries occurred at home (21.8%), on stairs (20.6%), or in public places (14.7%). Additionally, questionnaires conducted by the researchers revealed that stairs were perceived as a minor-to-moderate risk distraction environment with high rates of smartphone engagement.

However, most prior studies of distracted walking with smartphone use focused on walking performance on flat ground, where participants were asked to walk on horizontal surfaces such as floors and treadmills, encountering various road events or obstacles. Only a handful of studies have investigated walking performance on stairs with smartphones through a step-deck obstacle in controlled laboratories or through real stair scenarios on a campus.

The participants were asked to wear sports shoes to participate in the experiment. During preparation, the participants wore a pocket near the lower back to place a smartphone for gait assessment. They then practiced normal walking on stairs and escalators and used a smartphone (Galaxy S8+, Samsung, South Korea) during walking for 1–2 trials until they were comfortable with the testing environment. Participants received the auditory information via the built-in speakers, including the voice prompts of the start and end of gait data collection, and the sound of videos and games in walk-video and