

# Effects of Reading Books and Watching Movies on Inducement of Car Sickness

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## INTRODUCTION

Motion sickness is caused by a conflict of sensory information concerning body movement [1]. Since reading books or maps in a moving vehicle increases the visual-vestibular sensory conflict, it easily induces car sickness in passengers. Similarly, watching a movie via an onboard display, recently getting popular for rear-seat entertainment, likely accelerates development of car sickness. This study aimed to evaluate how severely reading books and watching movies in a vehicle affects the inducement of car sickness.

## METHODS

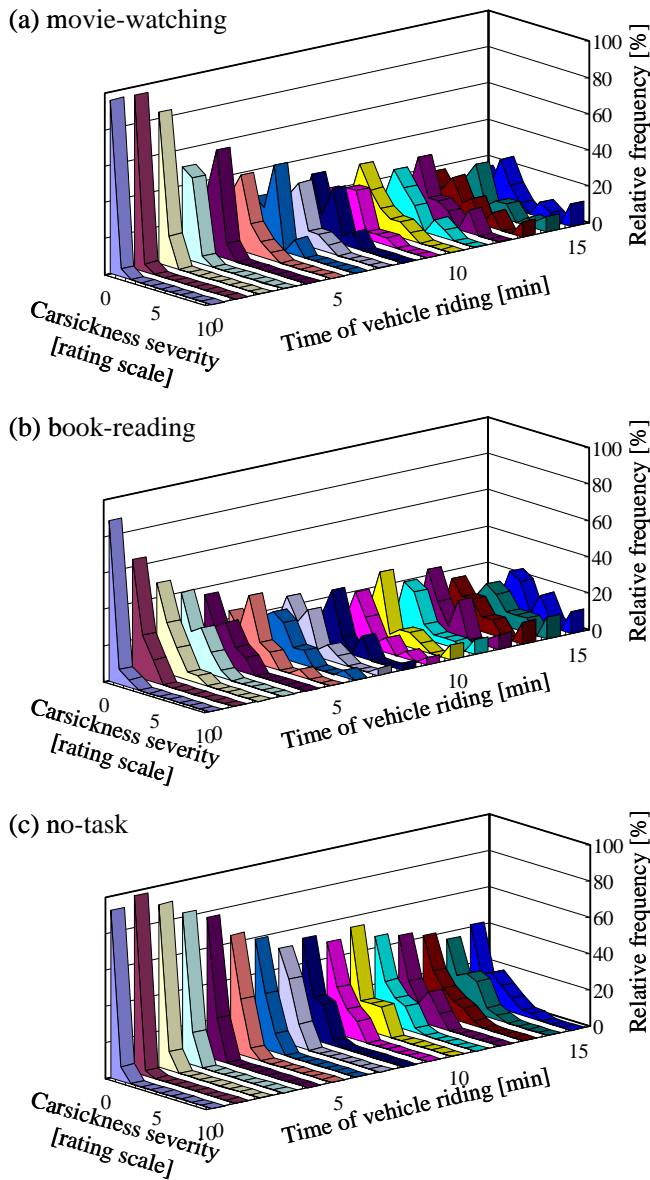
Thirty-one healthy subjects (21 males and 10 females), around 20 years of age, participated in the experiments (a total of 93 trials). Every subject was briefed on the purpose, procedures, risks and benefits of the study, and gave written informed consent before participating in the experiments.

The experiment was performed using a minivan-type car with three seat rows and a boarding capacity of 7 passengers. Two onboard displays with a 11 inch-type wide LCD panel were installed behind headrests of the first row of seats, and DVD movies were played. Car sickness was induced by driving the subjects in the car along a winding path for 15 minutes. They were assigned to one of the following three conditions during the car ride: 1) movie-watching, 2) book-reading, and 3) no-task conditions.

The subjective severity was measured by the rating-scale method using 11 numerical categories from 0 (normal condition with no sickness) to 10 (limit of subjects endurance of severe nausea). In the analysis of motion sickness severity, the rating scale was converted to a distance scale in accordance with the law of categorical judgment [2].

## RESULTS

The progression of car sickness severity is shown in histograms of Fig. 1, which were drawn to show a time-series. The severity was 0 (no sickness) at the beginning of vehicle riding (0 min) in almost all trials. It gradually increased in most trials under the movie-watching and book-reading conditions. On the other hand, the severity remained at 0 or below a level of mild discomfort, at the most, under the no-task condition.



**Fig.1 Histograms of progress of carsickness severity**

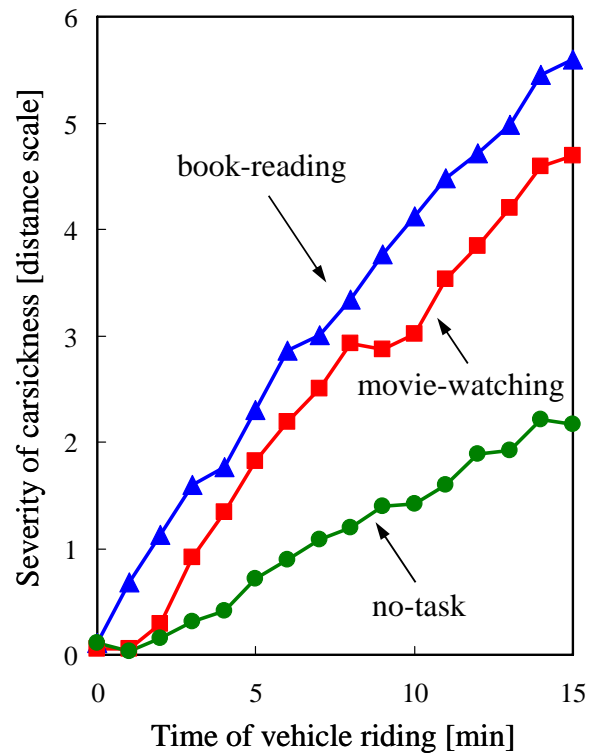
the lines for the book-reading, movie-watching and no-task conditions was 2.7 : 2.2 : 1, respectively. Thus, watching a movie on an onboard display aggravated car sickness more than twice as much as a usual riding without performing any task. The severity was two-tenth less than that caused by reading a book.

## CONCLUSION

The present experimental study showed that car sickness is remarkably aggravated by watching a movie in a moving vehicle. Considering that onboard displays are recently becoming popular, it is necessary to develop an onboard display designed to reduce car sickness.

## REFERENCES

- [1] Reason JT, Brand JJ. Motion Sickness. London: Academic Press; 1975
- [2] Torgerson WS. Theory and Methods of Scaling. New York: John Wiley and Sons; 1958



**Fig.2 Progress of carsickness**

Figure 2 shows the progression of car sickness severity under the three conditions at intervals of one minute. Each point in the figure indicates the average severity at the elapsed time of vehicle riding. The severity of car sickness increased in proportion to the period of vehicle riding. Regression lines were fitted to the courses of the severity so as to pass the origin. The ratio of the slopes of the lines for the book-reading, movie-watching and no-task conditions was 2.7 : 2.2 : 1, respectively.