

# Effects of tree aromas on automobile drivers' fatigue reduction and wakefulness assessed with finger-pulse fluctuations

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Keisuke Suzuki<sup>1</sup> & Shigeki Harada<sup>2</sup>

<sup>1</sup>Daido Institute of Technology

<sup>2</sup>Denso Corporation

Nagoya, Japan

## Abstract

The effects of tree aromas on an automobile driver's fatigue level, wakefulness, and active safety (e.g., keeping the appropriate time headway to the preceding vehicle) were investigated using a driving simulator. The fluctuation of the driver's finger pulse was used to analyze fatigue and sleepiness levels. Reaction time to visual stimuli was investigated, and vehicle manoeuvres were assessed with the variation of time margin to the preceding vehicle. It was found that the tree aroma Alpha-pinene minimizes the fluctuation of finger pulse and shortens the driver's reaction time to visual stimuli. Another tree aroma, Borneol, was found to minimize the driver's sleepiness level and thus help prevent swerving of the vehicle. It was concluded that supplying the aroma of trees as an air supplement helps lower a driver's fatigue and sleepiness levels, and thus is beneficial in terms of active safety during car driving.

## Introduction

Some analyses regarding the effects of tree aromas on fatigue reduction and wakefulness have been reported by Yatagai (1997, 2000), Sawada (2000), and Homma (2004). For instance, such studies revealed that inhaling Alpha-pinene (a main ingredient of Japanese cedar or cypress) activates the parasympathetic nervous system and relieves mental stress or fatigue; as a result, pulse rate and blood pressure decrease. Additionally, Borneol (a main ingredient of cypress, hemlock, and fir) was found to have an activating effect on the central nervous system and thus to enhance wakefulness.

This study addresses the effects of tree aromas as an air supplement on an automobile driver's fatigue reduction and wakefulness. Focus is on active safety, such as keeping the appropriate time headway to the preceding vehicle to avoid the risk of collision. Driver behaviour was investigated in terms of reaction time to visual stimuli, fatigue level, sleepiness level, and vehicle manoeuvres.

In this study, the effects of Alpha-pinene on reducing mental stress or fatigue caused by continuous long driving was investigated using the Lyapunov exponent of finger