## A Study on Gaze Control while Riding a Bicycle

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## Abstract

This study investigated the differences of gaze control in the different road conditions while riding a bicycle. The participant often looked at the space in front while riding uphill. The results indicate that the participant might not be fully aware of road signs and pedestrians compared to the other two conditions.

Bicycle is a vehicle with two or more wheels which a person rides by sitting on it and pushing two pedals with his feet <sup>[1]</sup>. As of 2019, the number of bicycles owned by Japanese is approximately 68 million which is about half of the population <sup>[2]</sup>.

Humans obtain most of their information about the external environment from the sense of sight during daily life and sports activities. Visual information is especially important to sense danger while riding a bicycle because we move faster than while walking. Several studies have described that a person looks far away while riding a bicycle with high speed and he looks closer with low speed. The range of eye movement tends to be narrower in the horizontal direction and wider in the vertical direction while moving with high speed. The range of eye movement tends to decrease in the direction of both horizontal and vertical while riding a bicycle with offbalance <sup>[3]</sup>.

Clarifying the characteristics of gaze control while riding a bicycle enables to determine the appropriate location of signs, which contribute to reduce the number of accidents caused by missing road signs. Therefore, this study investigates the differences of gaze control in the different road conditions while riding a bicycle.

A healthy adult male (height 1.76m, weight 65kg) participated in the experiment. The measurement was conducted at two locations in Hachioji City, Tokyo.



Fig. 1. Eye tracking system (EMR-9)

Table1	View point loca	itions
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А	Automobile
В	Road sign, Utility pole
С	Pedestrian
D	Ground
Е	Forward space
F	Own bike



(c) Uphill Fig. 2. Measurement results

Following an explanation of the purpose and requirements of the study, the participant gave his written informed consent to participate in the study. Study approval was obtained from the Research Ethics Board, Kogakuin University.

The participant wore the eye tracking system on his head shown in Figure 1 while riding a bike. The participant rode a bicycle on "flat roads", "sloping roads" in the urban area of Hachioji City, Tokyo. The sampling frequency of the eye tracking system was 60 Hz. Table 1 shows the grouping results of gaze point, and Figure 2 shows the results of the measurement. The analysis distance is approximately 100 m for each condition. The results indicate that the participant looked at the ground and the space in front most frequently on a flat road. The participants looked at pedestrians and bicycles more frequently on a downhill slope. On an uphill slope, the participant looked at the space in front more frequently than other two conditions.

## **References:**

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