

Optical Flow, Geometric Field of View, and Requested Vehicle Velocity

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Abstract

In a simulated driving scenario, we investigated the production of vehicle velocity at 30 and 60 mph while varying the amount of optical flow (roadside trees versus no trees) and the geometric field of view (25, 55, and 85 horizontal degrees). Participant drivers were significantly less accurate in producing vehicle velocities of 30 mph as contrasted with those of the 60 mph target set. On average, the produced velocities were overestimated by 20 mph for the 30 mph target set. This may be due to an inability of driving simulators to produce authentic optical flows when traversing at 30 mph or lower velocities.

1 Introduction

Driving an automobile is a good way to experience optical flow [Beall & Loomis, 1996]. The rate of optical flow and changes in the amount of optical flow, are important information with regard to vehicle control. Information from optical flow is important for drivers to 1) make heading corrections, 2) avoid collisions with other vehicles and static objects, and 3) negotiate curves [Land & Lee, 1994].

2 Results

A three-factor ANOVA was used to analyze the results. Tukey post hoc tests were used to establish the degree of pairwise significance of means for F ratios at $p < .05$.

All three main effects, Target Velocity, Optical Flow, and Geometric Field of View were highly significant with $p < .001$. A surprising finding was the amount of error resulting when participants attempted to produce a velocity of 30 mph. Here, the magnitude of error was nearly 20 mph over the target velocity.

Keywords: optical flow, driving simulator, FOV

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Figure 1: High optical flow condition.

3 Discussion

The finding that velocity production decreased as the GFOV gets larger was expected. This confirms the results of Adetiloye et. al. [2005] that participants perceive oncoming vehicle velocities to be faster when viewing an 85 degree GFOV as compared with smaller GFOVs. As noted if drivers feel that they are going faster at higher GFOVs, then production of velocity at these GFOVs would consequently be less.

The large amount of overproduction error (20 mph) found when subjects tried to produce a velocity of 30 mph has implications for all simulators that alter the viewer's position at low rates, i.e. walking and driving simulators. This result suggests that the production of a 30 mph velocity (and presumably slower velocities) in a simulator is very different from that in the real world.

References

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