

High quality bicycle tracks result in more efficient visual search patterns during cycling

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Introduction

For a bicyclist to participate safely in busy traffic the ability to foresee events and hazards is vital (Hosking et al. 2010). Therefore, it is important that the bicycle environment allows a shift of attention from the 'personal space' towards traffic events and other traffic users. One factor that might demand a significant proportion of the attention capacity is the quality of the cycling tracks. The presence of irregularities in the surface might prevent the visual attention to shift towards the wide environment (Pelz, 2007), resulting in bad or late decisions that might affect the safety of bicycle users. The aim of this experiment is to investigate to what extent the cycle track surface quality affects visual attention as measured by eye tracking in adult bicycle users.

Methods

Six adults, used to cycling, cycled a tour of 4km in Ghent wearing the iView X HED eye tracker (SensoMotoric Instruments, Berlin, Germany) which recorded eye movements at 50 Hz and a scene video, operating at 25Hz. The route included two bicycle tracks with approximately the same width and similar environment but with different surfaces. One bicycle track was recently renovated and had a brick surface; the other had a surface of large tiles that showed several deformities and cracks. We referred to these tracks respectively as the 'high quality' and 'low quality' cycle track. Both tracks were physically separated from the carriageway by trees and/or parked cars. Since direct sunlight disturbed the infra red signal of the eye tracking system, all tests were performed in overcast but dry weather.

A 30s trial was selected for eye tracking analysis on both the high and low quality track. Gaze cursor overlay videos were analyzed and gaze location was labeled frame by frame as one of the following 5 areas: road, Focus of Expansion (FoE), side (boundaries of cycling track), external and 'other cyclists on track'. When no gaze cursor was visible (no data or gaze outside of camera

view) frames were labeled as 'no data'. Fixation duration of 'other cyclists on track' was filtered out and gaze location percentages were calculated per area of interest. Gaze percentages were analyzed using repeated measures MANOVA in which 'quality of the cycling track' was the within-subjects factor and the fixation locations were the dependent variables.

Results and conclusion

Gaze of cyclists was significantly more directed to the road region on the low quality than on high quality cycling track (av. Resp. 66,5% and 24,3%; $F=19,942$ $p=0,007$). Cyclists spend less time watching the side of the road and external stimuli on the low quality than on the high quality cycling track (Resp. av. 21.3% vs. 8.3%; $F=8.507$ $p=0.033$ and 22.2% vs. 6.7%; $F=12.791$ $p=0.16$).

Low quality bicycle tracks lead to a less anticipatory visual strategy. Due to the low cycle track quality the cycling task itself became more demanding, which resulted in a shift of attention from distant environmental regions to more proximate road properties. It can be concluded that a low quality cycle track may affect the alertness and responsiveness of the cyclist to environmental hazards.

References

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