

The Effects of Differences in Drivers' Brain Activity on Recognition of Left- and Right-Hand Curves and Driving Performance

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Drivers repeatedly engage in recognition, judgment, and operation processes while driving, among which many traffic accidents result from errors in recognition processes. This study focused on the drivers' brain activity in the prediction section, which is the stage before recognition, and investigated the relationship between brain activity and superior or inferior driving performance for left- and right-hand curves from experiments using a driving simulator. A circuit course consisting of straight and curved sections was created. Each corner was categorized into prediction, recognition, judgment, and operation sections. Using near-infrared spectroscopy, oxygenated hemoglobin concentrations were measured at four locations in the prefrontal cortex. The subjects were 8 men with an average age of 21.1 ± 0.3 .

As a result in figures 1 and 2, it was found that for both left- and right-hand curves, when activation of the right prefrontal cortex (MP①) in the prediction section, the amount of lane departure in the curve section was decreased. The dorsolateral prefrontal cortex, located near the right prefrontal cortex (MP①), is considered to be associated with functions such as working memory and spatial knowledge. It is thought that the right prefrontal cortex (MP①) was activated in superior drivers because they were engaged in retaining and interpreting visual information, regardless of whether the curve was to the left or the right. Furthermore, in the right-hand curves, when activation of the right frontal pole (MP②) in the prediction section, the amount of lane departure in the curve section was decreased. An analysis of the subjects' gaze behavior revealed that when driving through right-hand curves, they scanned a wider area and tended to shift their gaze more frequently compared to when driving through left-hand curves; this was likely due to the presence of an oncoming traffic lane. This increased gaze shifting associated with visual scanning is thought to have activated the right frontal pole (MP②), a region linked to gaze movement, during right-hand curve navigation. Therefore, by monitoring the activity in these areas and establishing methods to enhance them, it may be possible to improve driving performance on curved roads.

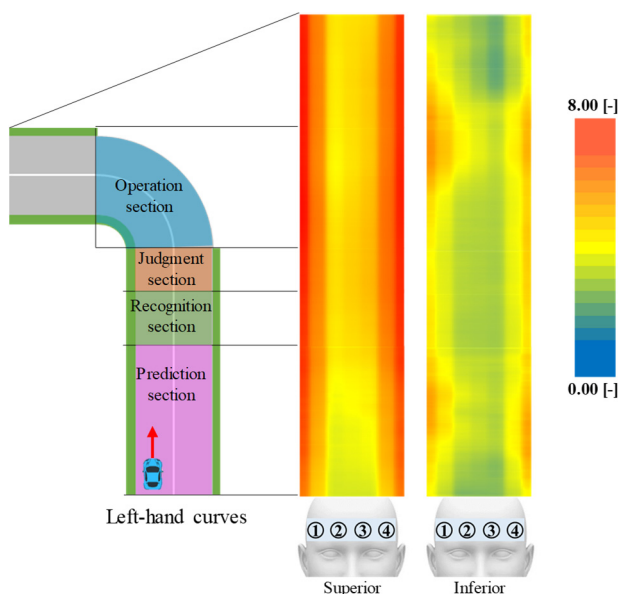


Fig.1 Cerebral blood flow for the left-hand curves

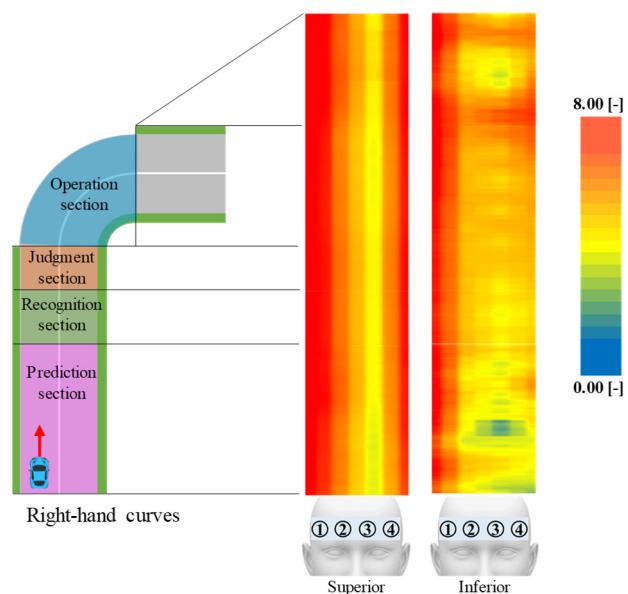


Fig.2 Cerebral blood flow for the right-hand curves