

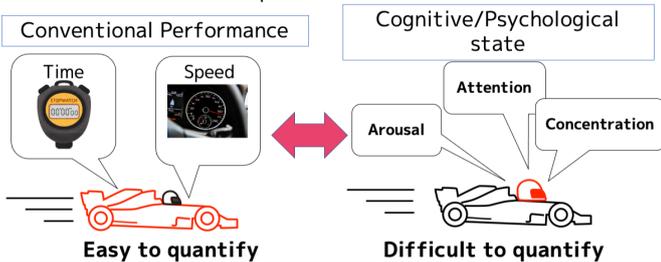
Blink pattern of elite car race drivers

Abstract

How do formula car drivers process the stream of information from the external world during ultra-high-speed driving? In this study, we focused on **spontaneous blinking** and captured **the dynamic changes in the psychological and cognitive states** that top Japanese drivers exhibit when driving around a circuit. As the lap speed increased, the drivers blinked at particular locations on the track and these locations were common between the drivers. We revealed for the first time that racers adjust their psychological and cognitive states to control their cars in distinct areas on the track with increasing lap speed. **In future, we aim to decode these states that even professionals themselves do not understand through the unconscious physiological phenomena.** By clarifying the implicit information processing occurring in the brain that leads to superior performance, we pursue a society where people can easily improve their desired skills.

Quantification of cognitive/psychological metrics in sports

It is difficult to examine athletes' psychological and cognitive states based on the measurement of conventional metrics of performance.



Spontaneous blinks reflect psychological and cognitive states

The frequency of **spontaneous blinking** is known to vary with emotion and task. For example,

Anger -> **Blink Frequency+**



Reading Task -> **Blink Frequency-**

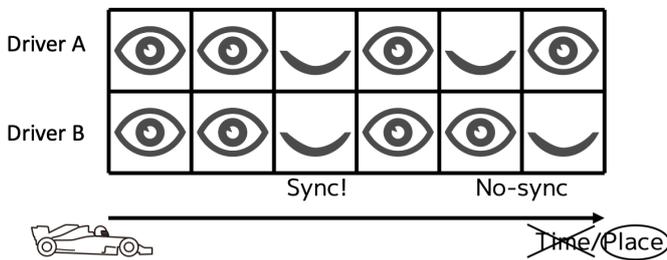


Blinks may capture psychological and cognitive states.

Blink patterns during race car (formula car) driving

Assume that **similar blink behaviors occur when drivers are in similar psychological and cognitive states.**

Q: Do they blink at similar locations during lap iterations? (**synchronization**)

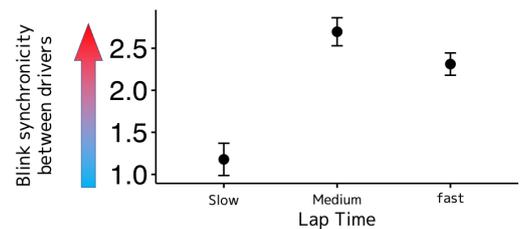


Blinks were synchronized at specific positions on the course.
 → The drivers were not always in the same psychological and cognitive state. Instead, they fine-tuned their state depending on their position on the course.

Both of the drivers blink at similar positions on the course, although the number of blinks in a lap greatly varies between them.
 → This biased pattern may be a trait of elite-level drivers.

► It may be possible to visualize and quantify fine attentional control by examining blink patterns.

Q: What is the relationship between driving performance and blink synchronicity?



The degree of synchronization correlated with the speed of the lap.

→ It may reflect psychological and cognitive load associated with the difficulty of the drive.

► The strength of synchronization between athletes may be a measure of the psychological and cognitive load imposed by the task.

Summary and future research

- ✓ A course position- and speed-dependent blink pattern was found during race car driving.
- ✓ Blink patterns may provide a quantitative representation of psychological and cognitive states.
- ✓ Future studies should examine differences at various competition levels and applicability to other disciplines.

References

[1] R. Nishizono, N. Saijo, M. Kashino, "Synchronization of Spontaneous Eyeblink during Formula Car Driving", in *Proc. The 13th ACM Symposium on Eye Tracking Research and Applications (ETRA)*, 2021.

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