Psychophysiological Monitoring During Simulated and Actual Car Race in World Series by Renault Driver

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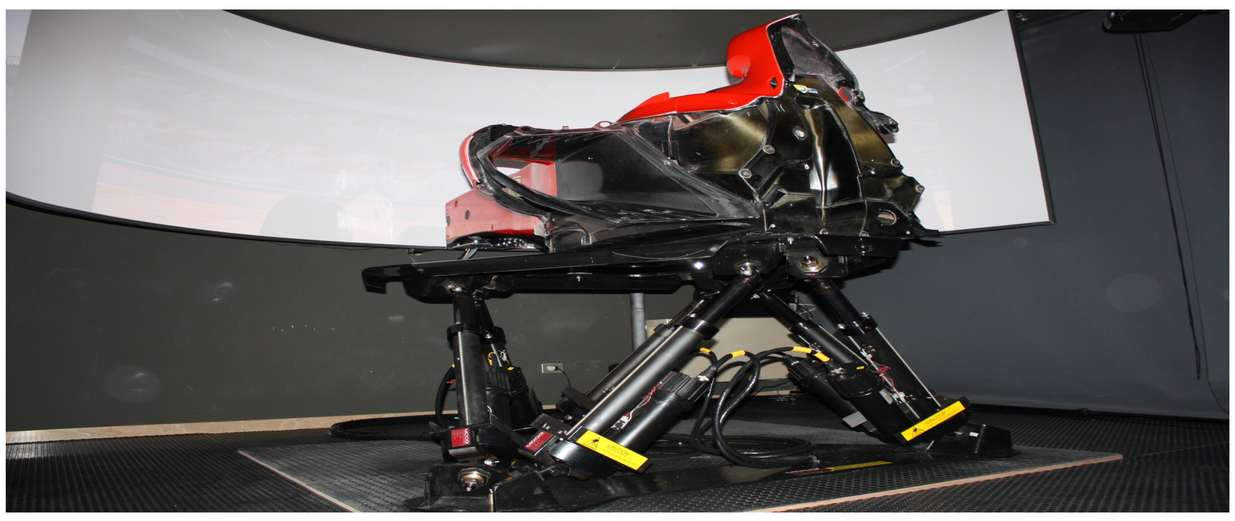
Introduction

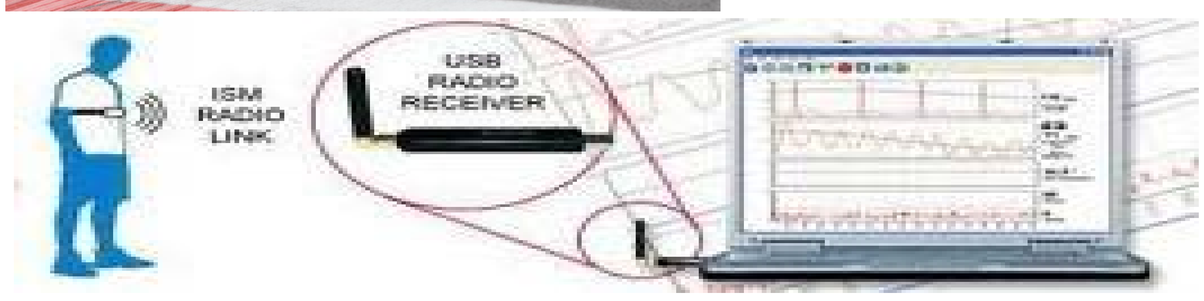
Car race is a demanding sporting performance involving high levels of physical and mental workload. Abernethy et al. (2007) noted that heart rate variability (HRV) can provide a particularly promising physiological indicator of attentional workload. During car race, HRV is influenced by acceleration (Yamakoshy et al., 2010). In order to investigate the cognitive workload of a car driver we developed a protocol study in which the psychophysiological and kinematic profiles associated with performance were monitored.



Method

An elite World Series by Renault driver took part in the study. The psychophysiological responses and kinematic data during simulated practice and actual practice were monitored through the ADInstruments BioHarness Telemetry System. The A1GP dynamic simulator (Allinsport, Modena IT) was used in conjunction with the RFactor PRO software to simulate the Vallelunga (RM, IT) circuit.

We collected ECG Trace, Heart Rate, Respiratory Rate, Posture, and Acceleration data through the ADInstruments BioHarness Telemetry System. These recorded biopotentials were then analyzed using LabChart (ADIntruments) and Kubios software (Kuopio, Finland). Statistical analysis was conducted for Heart Rate, Respiratory Rate, and posture, during simulated and actual practices. Moreover, we examined HRV related to track and dynamic simulator driver using the methodology suggested by the European Task force (1996) and Aubert et al. (2003).



Results

Results showed different kinematic profiles during simulated and actual car race driving. The influence of acceleration on the cardio-respiratory system was not as explicit as that indicated by Yamakoshi and colleagues (2010). Autonomic responses suggested that attentive resources allocated during simulated and actual car driving were different. The lower HRV found in simulated practice compared to actual practice is in line with the results of earlier research in golf (Neumann & Thomas, 2009).

Variable	Simulator	Track
Posture	- 50,4°	- 65 °
Vector Mag. U.	0,05 VMs	1,02 VMs
Peak Accel.	0,1 gs	1,65 gs
Resp. Rate	20,6 cpm	22,3 cpm
Mean RR	574 ms	456 ms
HR (average)	104 bpm	133 bpm
SDNN	44 ms	53,4 ms
RMSSD	28 ms	48,7 ms
NN50	15	44
VLF	931,18 ms2	1637,92 ms^2
LF	594,23 ms^2 (55,311 nu)	1333,86 ms^2 (52,408 nu)
HF	376,76 ms^2 (35,069 nu)	1187,799 ms^2 (47,100 nu)
LF/HF	1,57	1,124

Conclusion

The psychophysiological and kinematic assessment methodology adopted in this study can be effectively used to investigate a range of attentional processes occurring during simulated practice and actual practice. This rather unobtrusive methodology enables a continuous assessment during performance, and therefore is expected to foster research in car driving.

References

Abernethy, B., Maxwell, J. P., Masters, R. S. W., Van Der Kamp, J., & Jackson, R. C.(2007). Attentional processes in skill learning and expert performance. In G. Tenenbaum & R. C. Eklund, (Eds.), *Handbook of Sport Psychology* (3rd ed., pp. 245–283). Hoboken, NJ: Wiley.

Aubert, A. E., Seps, B., & Beckers, F. (2003). Heart rate variability in athletes. *Sports Medicine, 33,* 889-919.

Neumann, D. L., & Thomas, P. R. (2009). The relationship between skill level and patterns in cardiac and respiratory activity during golf putting. *International Journal of Psychophysiology, 72,* 276-282.

Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology. (1996). Heart rate variability: Standards of measurement, physiological interpretation and clinical use. *Circulation, 93,* 1043-65.

Yamakoshi, T., Matsumura, K., Yamakoshi, Y., Hirose, H., & Rolfe, P. (2010). Physiological measurements and analyses in motor sports: A preliminary study in racing kart athletes. *European Journal of Sport Science, 10,* 397-406.

13th FEPSAC European Congress of Sport Psychology
Sport and Exercise Psychology: Human Performance, Well-Being and Health
12th - 17th July 2011 - Madeira Island - Portugal