Short and Long Individual Time-Trials Involve Intermittent Exercise Intensity Regulation

Théo OUVRARD, Alain GROSLAMBERT, Fred GRAPPE

EA4660, C3S Health - Sport Department, Sports University, Besancon, France

Key role of pacing strategies for the performance

(Noakes, 2011; Tucker, 2009; Marcora, 2008)

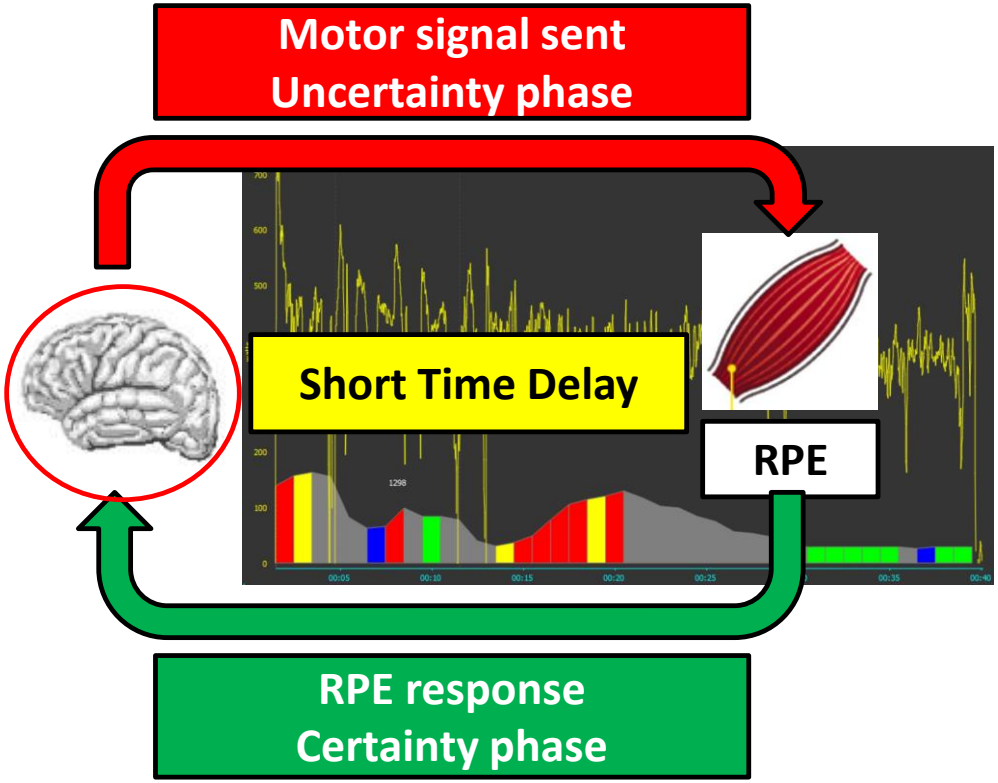
Prior experience
Mauger et al., 2009

Optimal strategy

Even pacing
(Abbiss and Laursen, 2008)

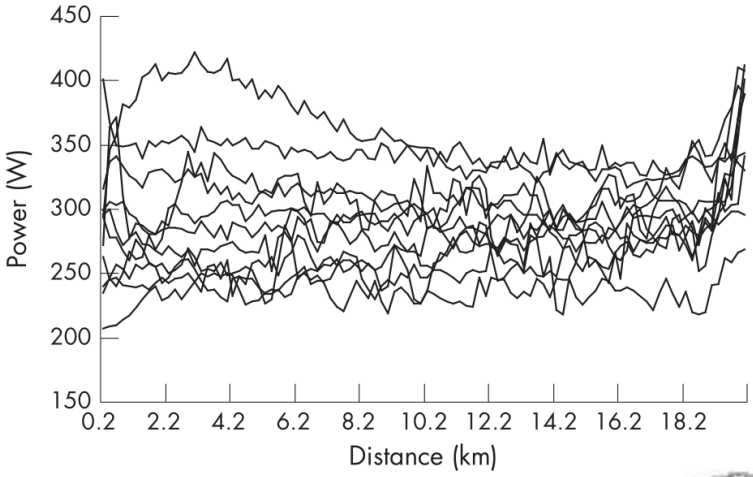
Live control of the exercise intensity by the brain

(Tucker, 2009; Mauger et al., 2014; Marcora, 2008)



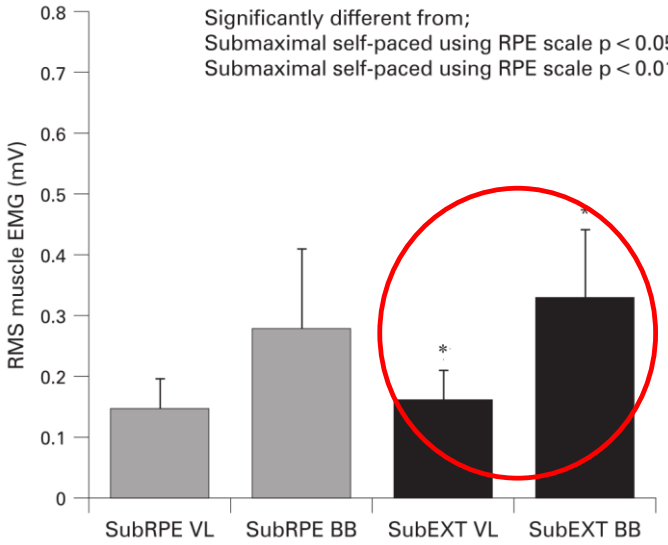
(St-Clair Gibson et al., 2006)

Live control of the exercise intensity by the brain



Power Output distribution and frequency during a 20km ITT

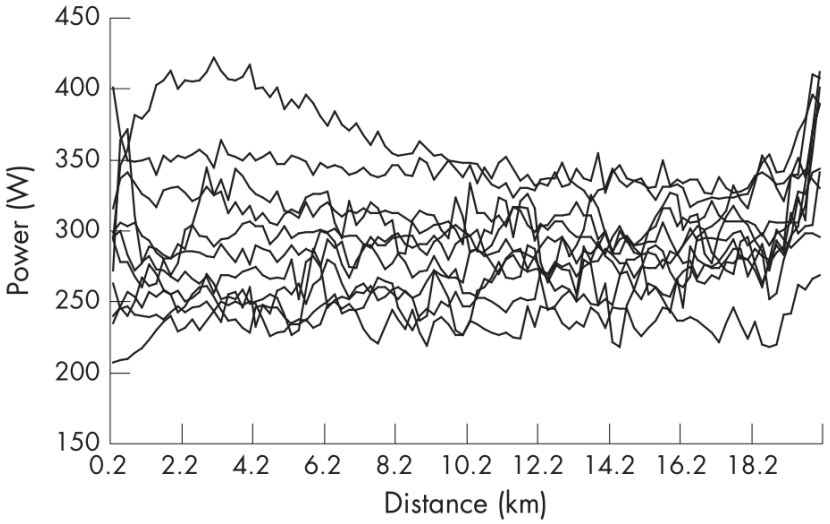
(Tucker et al., 2006)

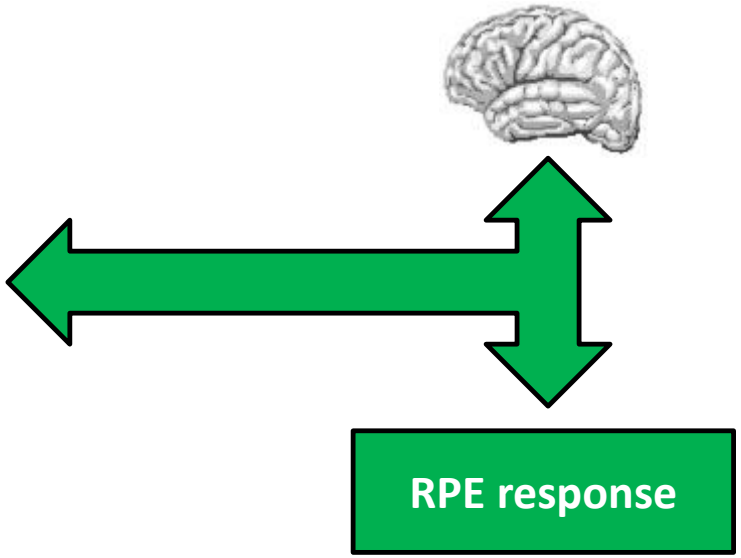


Greater iEMG during externally paced exercise than during RPE paced exercise at same intensity

(Landers et al., 2009)

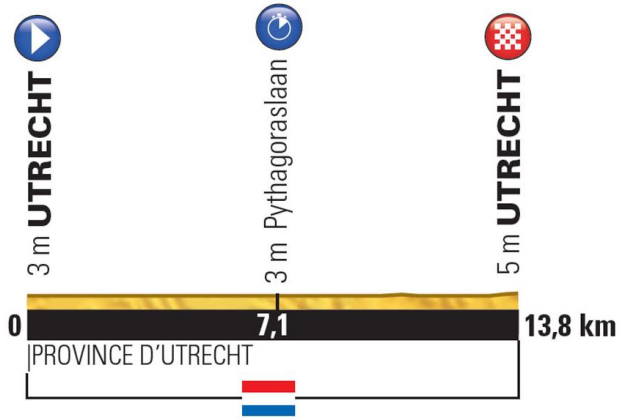
Live control of the exercise intensity by the brain





Do these short PO fluctuation exist during field competition ?

Data collection



Short ITT

(2015 Tour de France Short initial ITT)

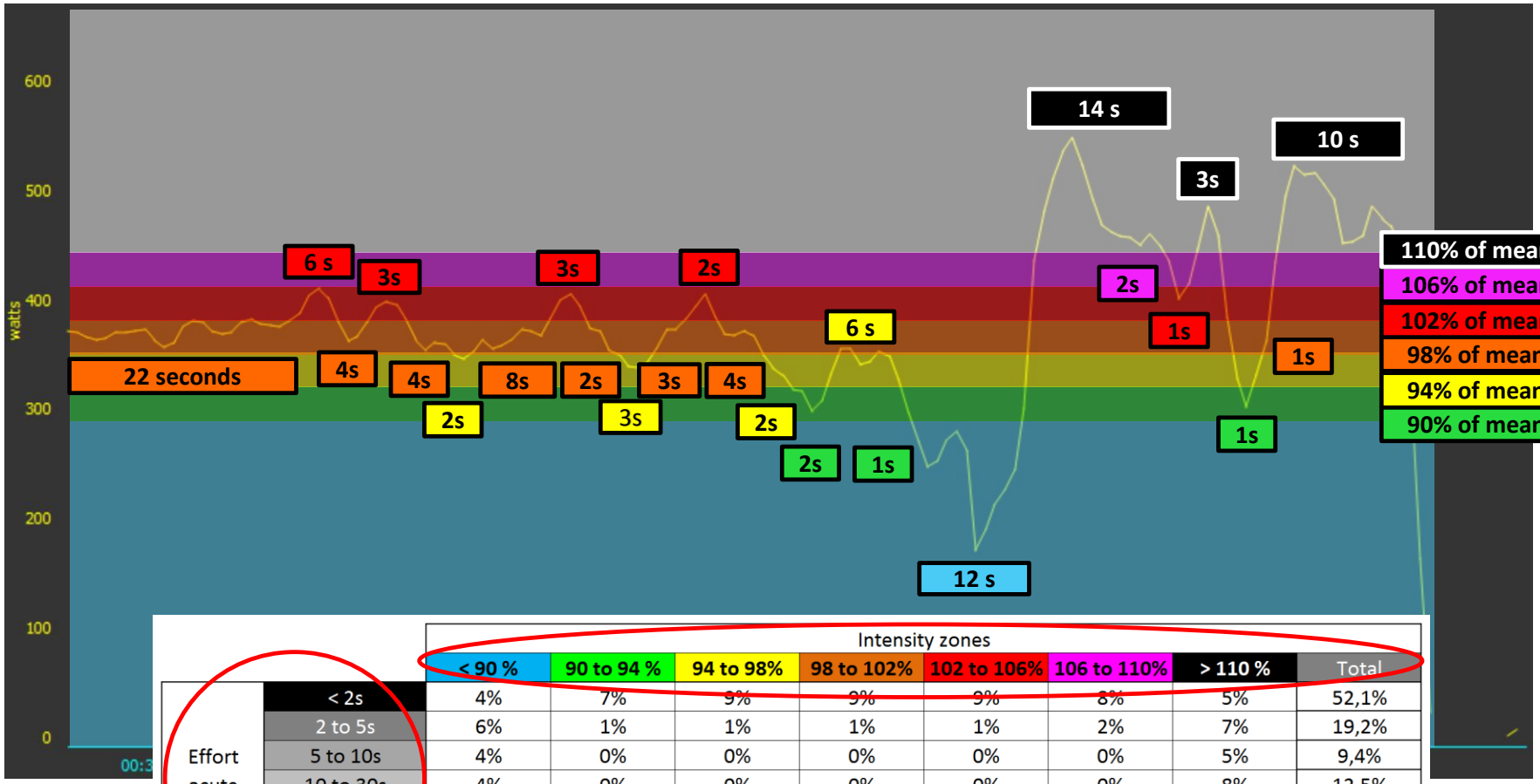
Long ITT

(2013 Tour de France 2nd week ITT)

3 UCI World Tour cyclists

Exposure Variation Analysis (E.V.A.)

(Abbiss et al., 2011 ; Peiffer and Abbiss, 2011)



		Intensity zones							
		< 90 %	90 to 94 %	94 to 98%	98 to 102%	102 to 106%	106 to 110%	> 110 %	Total
Effort acute duration	< 2s	4%	7%	9%	9%	9%	8%	5%	52,1%
	2 to 5s	6%	1%	1%	1%	1%	2%	7%	19,2%
	5 to 10s	4%	0%	0%	0%	0%	0%	5%	9,4%
	10 to 30s	4%	0%	0%	0%	0%	0%	8%	12,5%
	30s to 1min	0%	0%	0%	0%	0%	0%	3,1%	3,1%
	> 1min	0%	0%	0%	0%	0%	0%	3,6%	3,6%
	Total	19%	9%	10%	10%	10%	10%	32%	100,0%

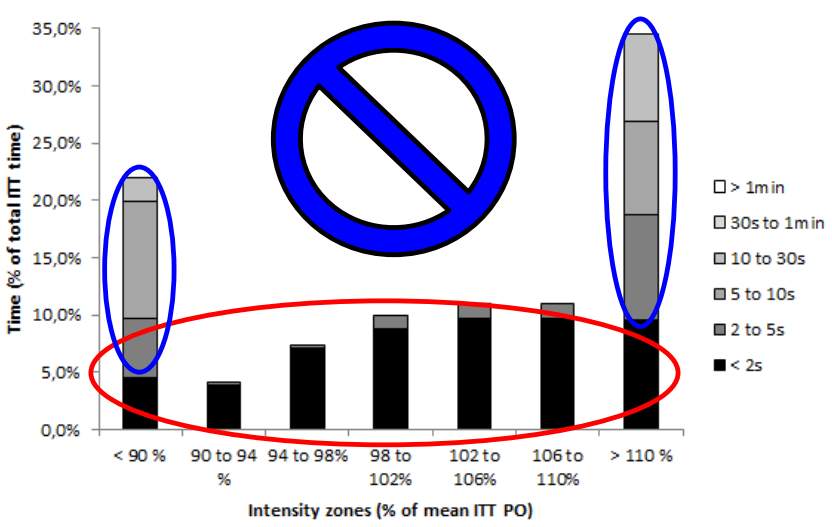
Exposure Variation Analysis (E.V.A.)

Long ITT

Mean P.O = 374 ± 7 w

		Intensity zones							
		< 90 %	90 to 94 %	94 to 98%	98 to 102%	102 to 106%	106 to 110%	> 110 %	Total
Effort acute duration	< 2s	4,5%	3,9%	7,1%	8,8%	9,7%	9,8%	9,6%	53,3%
	2 to 5s	5,2%	0,4%	0,3%	1,2%	1,3%	1,2%	9,2%	18,6%
	5 to 10s	10,2%	0,0%	0,0%	0,0%	0,0%	0,0%	8,2%	18,3%
	10 to 30s	2,1%	0,0%	0,0%	0,0%	0,0%	0,0%	7,6%	9,7%
	30s to 1min	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%
	> 1min	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%
	Total	22,0%	4,2%	7,3%	10,0%	11,0%	10,9%	34,5%	100,0%

Intensity zones and acute effort duration repartition

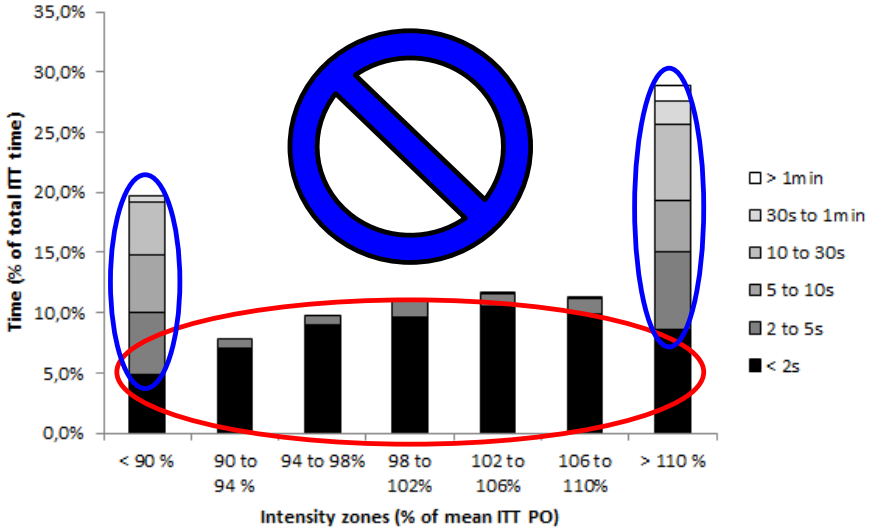


Short ITT

Mean P.O = 414 ± 15 w

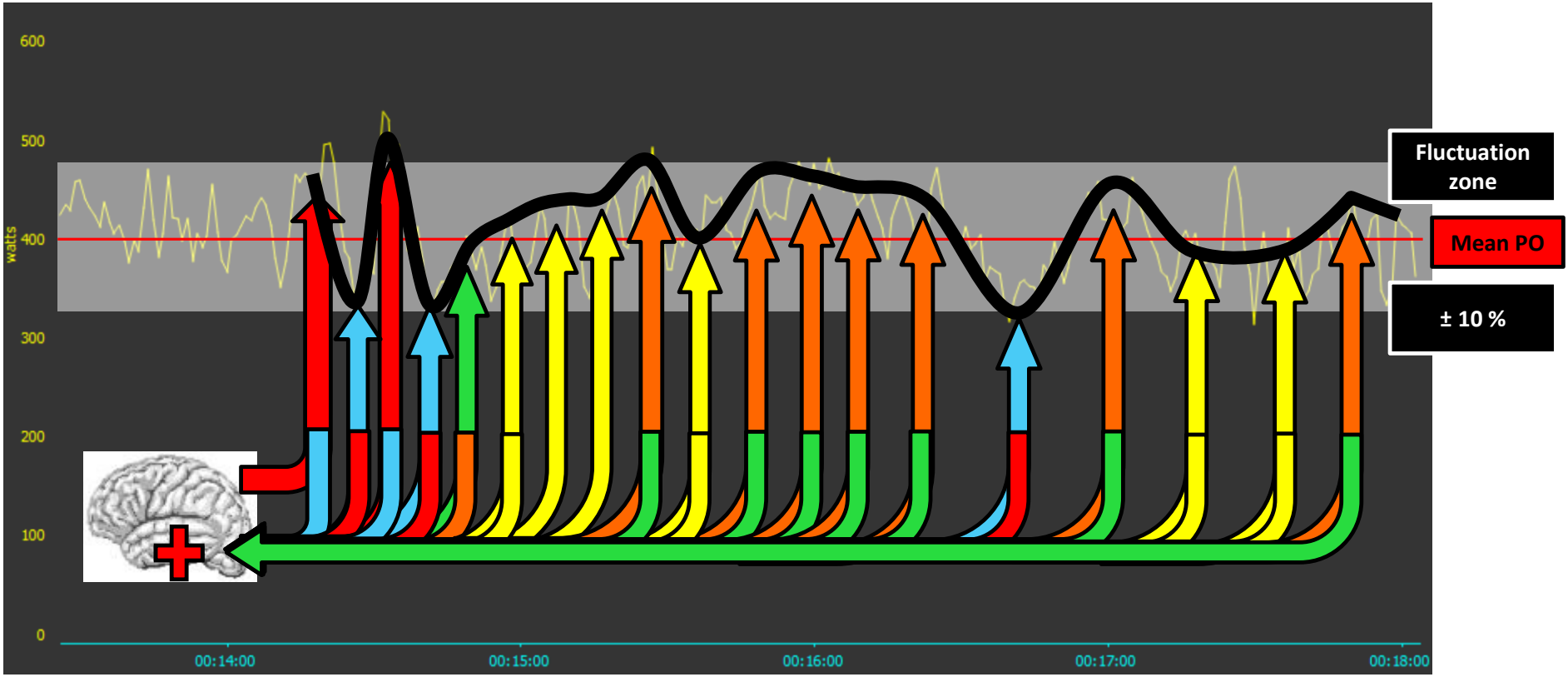
		Intensity zones							
		< 90 %	90 to 94 %	94 to 98%	98 to 102%	102 to 106%	106 to 110%	> 110 %	Total
Effort acute duration	< 2s	4,9%	7,1%	9,0%	9,6%	10,5%	9,9%	8,6%	59,6%
	2 to 5s	5,2%	0,7%	0,7%	1,4%	1,0%	1,3%	6,4%	16,8%
	5 to 10s	4,7%	0,0%	0,0%	0,0%	0,1%	0,1%	4,4%	9,3%
	10 to 30s	4,4%	0,0%	0,0%	0,0%	0,0%	0,0%	6,3%	10,7%
	30s to 1min	0,5%	0,0%	0,0%	0,0%	0,0%	0,0%	2,0%	2,4%
	> 1min	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	1,2%	1,2%
	Total	19,7%	7,8%	9,7%	11,0%	11,6%	11,3%	28,8%	100,0%

Intensity zones and acute effort duration repartition

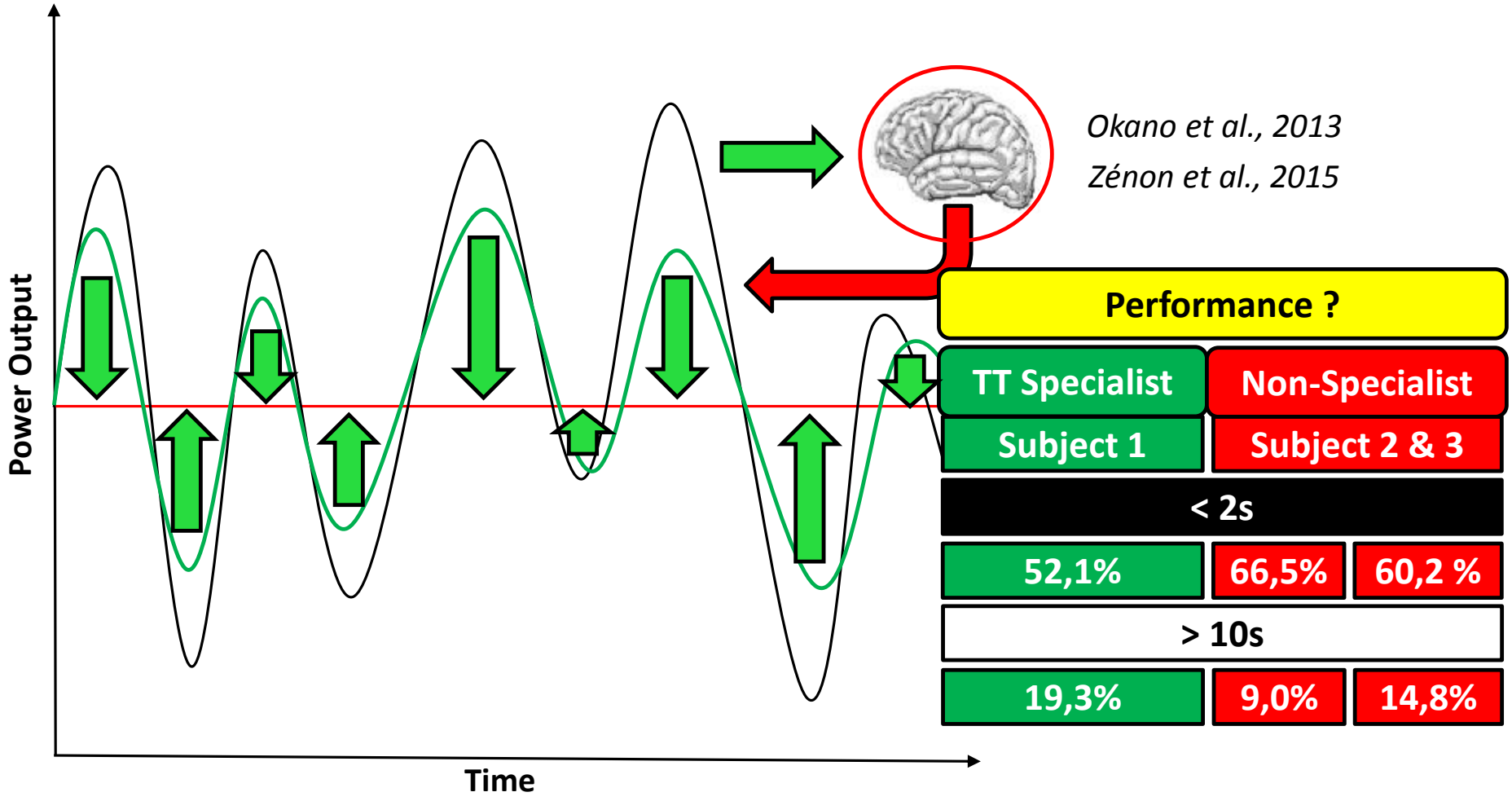


Live control of the exercise intensity by the brain

(St-Clair Gibson et al., 2006)



Live control of the exercise intensity by the brain



Future studies

French national I.T.T. Championship

Performance | **Time-Trial experience** | **Psychological parameters** | **Pacing strategy**

References

Abbiss CR and Laursen PB (2008). Describing and understanding pacing strategies during athletic competition. Sports Med 38(3): 239-52.

Abbiss C, Straker L, Quod M, Martin D, and Laursen P (2010). Examining pacing profiles in elite female road cyclists using exposure variation analysis. Br J Sports Med 44: 437-442

Lander PJ, Butterly RJ and Edwards MA (2009). Self-paced exercise is less physically challenging than enforced constant pace exercise of the same intensity: influence of complex central metabolic control. Br J Sports Med 43: 789–795

Marcora S (2008). Do we really need a central governor to explain brain regulation of exercise performance? Eur J Appl Physiol 104: 929-931

Mauger AR (2014). Factors affecting the regulation of pacing: current perspectives. Open Access Journal of Sports Medicine 5: 209–214

Peiffer J and Abbiss CR (2011). Influence of Environmental Temperature on 40 km Cycling Time-Trial Performance. International Journal of Sports Physiology and Performance 6(2): 208-220.

St Clair Gibson A, Lambert EV, Rauch LHG, Tucker R, Baden DA, Foster C, Noakes TD (2006). The role of information processing between the brain and peripheral physiological systems in pacing and perception of effort. Sports Med 36: 705-722.

Tucker R, Bester A, Lambert EV, Noakes TD, Vaughan CL, and St Clair Gibson A (2006). Non-random fluctuations in power output during self-paced exercise. Br J Sports Med 40: 912-917

Tucker R (2009). The anticipatory regulation of performance: the physiological basis for pacing strategies and the development of a perception-based model for exercise performance. Br J Sports Med 43: 392-400