

The new Exposure Variation Analysis (EVA) method to compare pacing strategy and performance during professional time-trial competitions



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INTRODUCTION

Pacing strategy and Individual Time-Trial Performance



Optimal pacing strategy

Atkinson et al., 2007
Cangley et al., 2011
Wells et al., 2016

Abbiss et al., 2008
Foster et al., 1993
Tucker, 2009



Biomechanical modelling

Reduce biomechanical losses

**Improve performance for a
same mean PO**

Psychophysiological aspects

Reduce fatigue

Improved mean PO

Improved performance

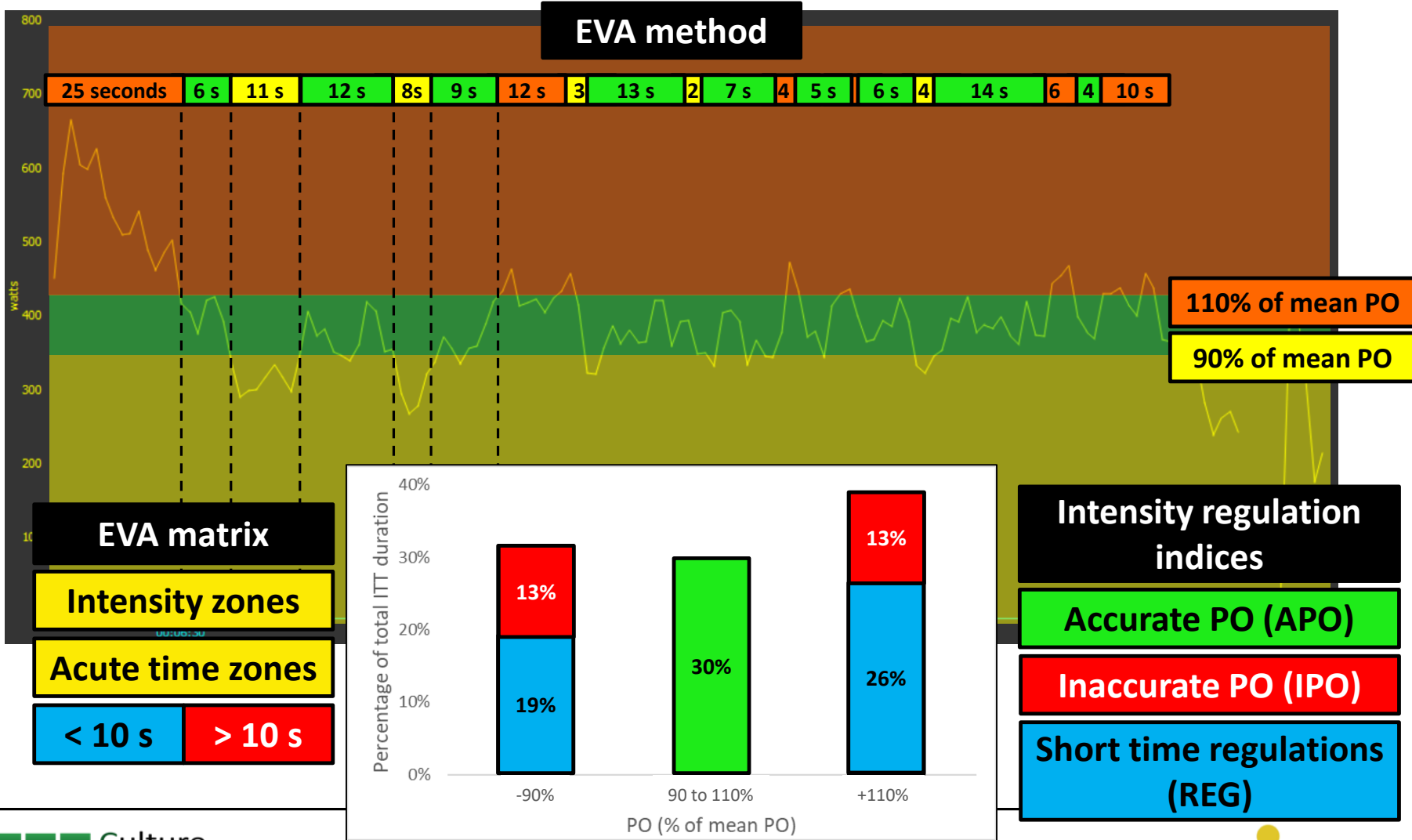
Ouvrard, Pinot, Gros Lambert & Grandjean

The new Exposure Variation Analysis (EVA) method for determining the optimal pacing strategy and performance during professional time-trial competitions

INTRODUCTION

Exposure Variation Analysis (EVA)

Abbiss et al., 2010; Mathiassen and Winkel, 1991



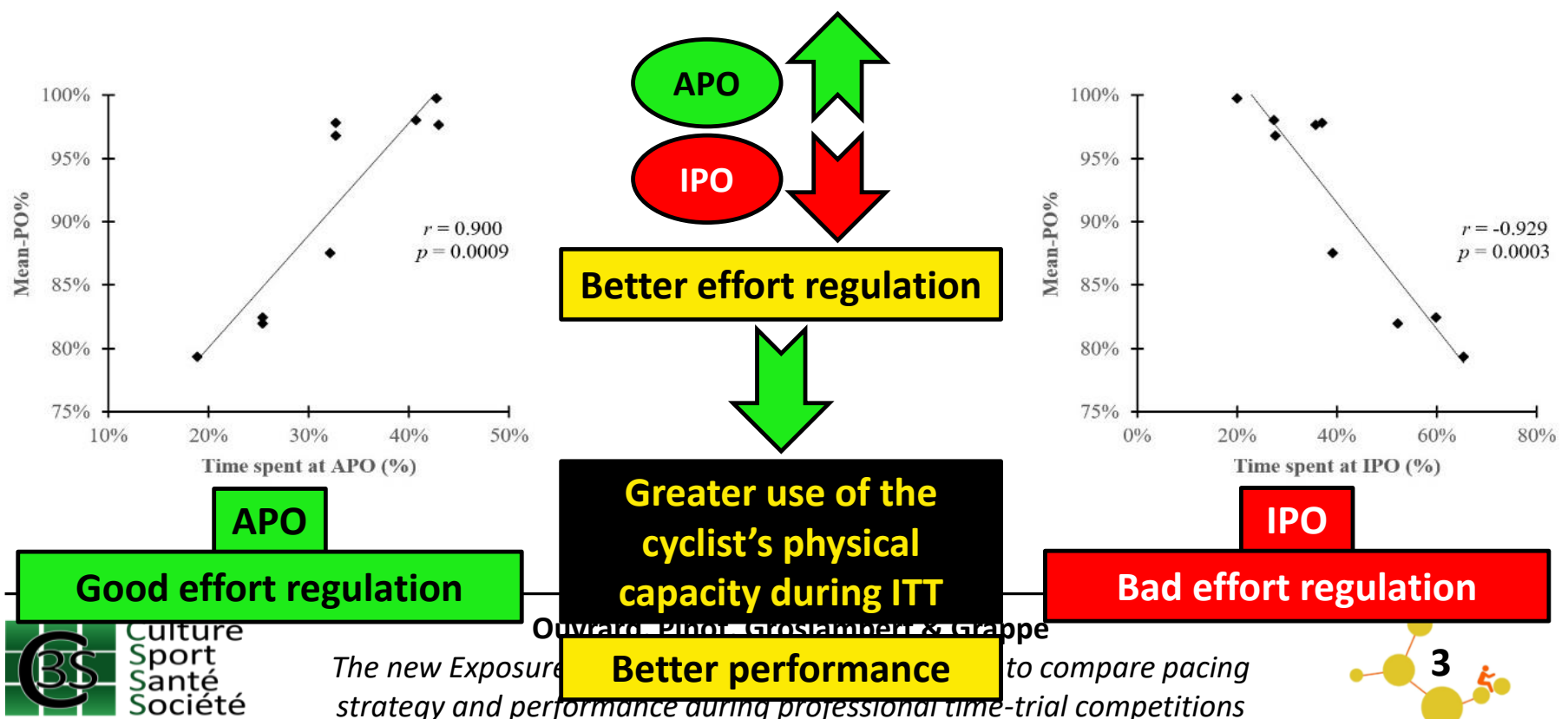
INTRODUCTION

Exposure Variation Analysis to study exercise intensity regulation during ITT

Ouvrard et al., under review

APO	Each seconds spent at a constant mean PO, optimal for performance
IPO	Each prolonged effort at a too low or too high PO regarding optimal pacing strategy
REG	Short-time regulations to avoid prolonged efforts at too low or too high PO

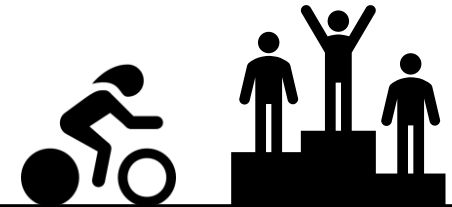
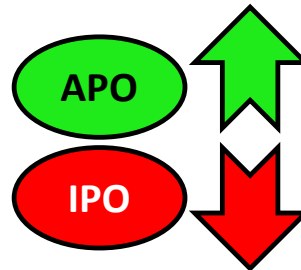
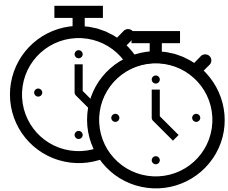
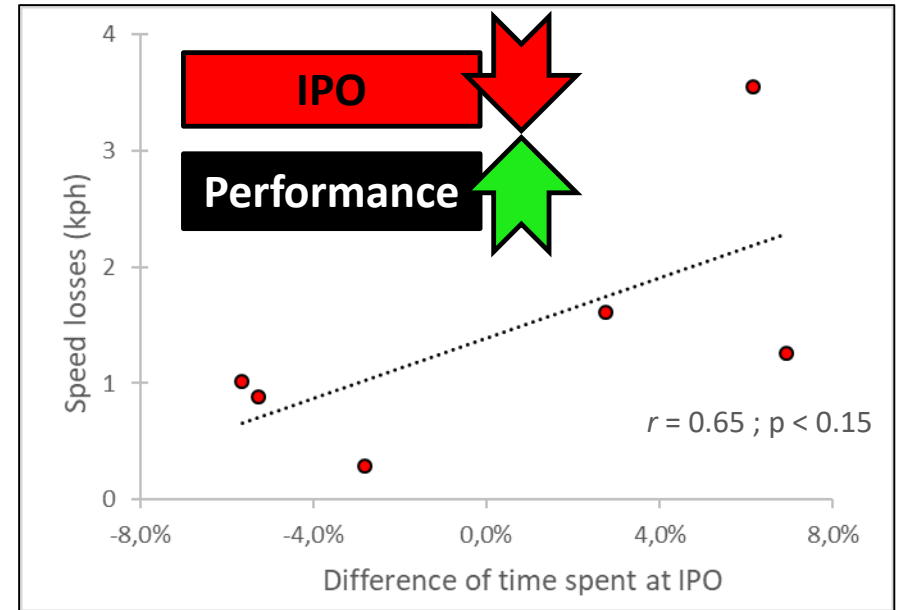
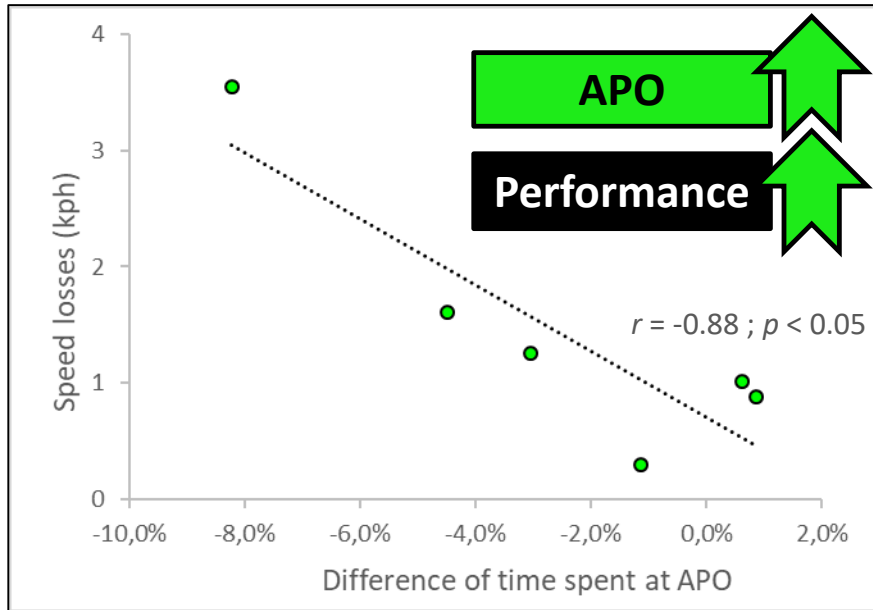
Parameters the more significantly related to performance during national ITT championship



INTRODUCTION

Exposure Variation Analysis to study exercise intensity regulation during ITT

Ouvrard et al., 2017



2 ITT on the same course

Better effort regulation

Improved performance

METHODS

Data collecting



2 World-Tour riders, with similar characteristics (60-min record PO 374 vs 355 W, good performers ITT = Top 3 on national ITT championship)



7 official professional competitive ITT:

- 2 ITT National Championships (2016 and 2017)
- 1 Tour de France ITT (2013)
- 4 World-Tour stage race ITT (2013, 2014, 2015, 2016)

Performed between April 2013 and June 2017. Ranged from 18.7 km to 51.6 km.



PO recorded thanks to SRM power meters:

- Mean PO (in Watts and expressed as % of cyclist's record PO for ITT duration)
- EVA analysis = Time spent at APO, IPO and REG



METHODS

Data analysis

APO	Each seconds spent at a constant mean PO, optimal for performance
IPO	Each prolonged effort at a too low or too high PO regarding optimal pacing strategy
REG	Short-time regulations to avoid prolonged efforts at too low or too high PO
Main problem = EVA indices vary depending to the ITT course	
How to standardise EVA indices to compare several ITT on different courses ?	

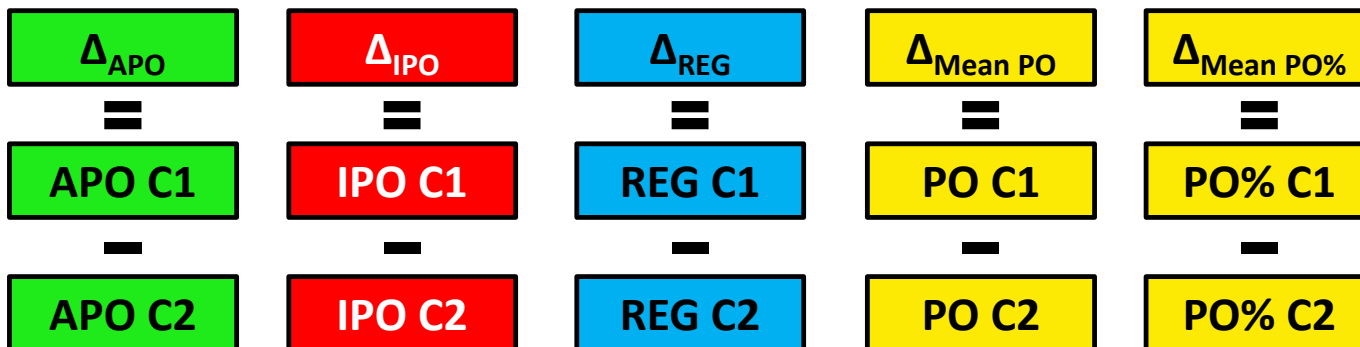


2 World-Tour riders, with similar characteristics

1 analysed cyclist (C1)

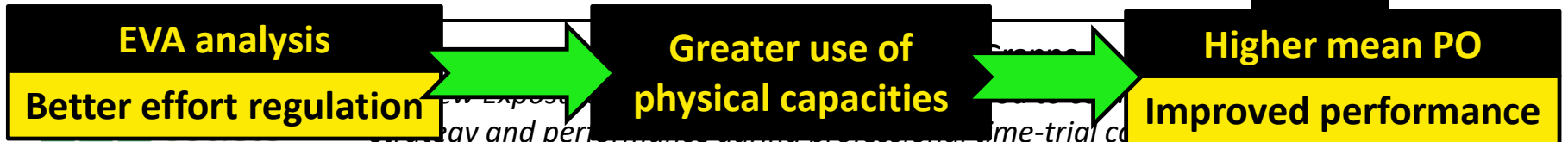
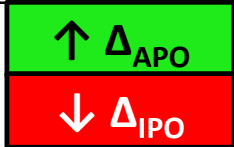
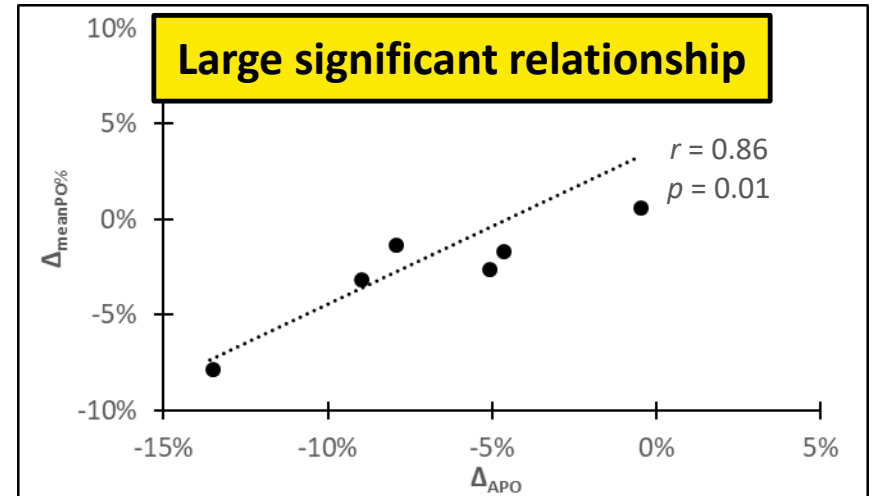
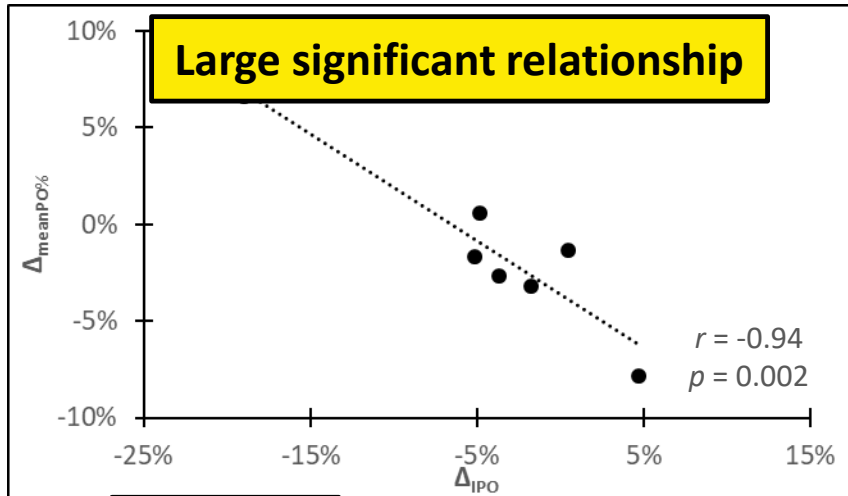
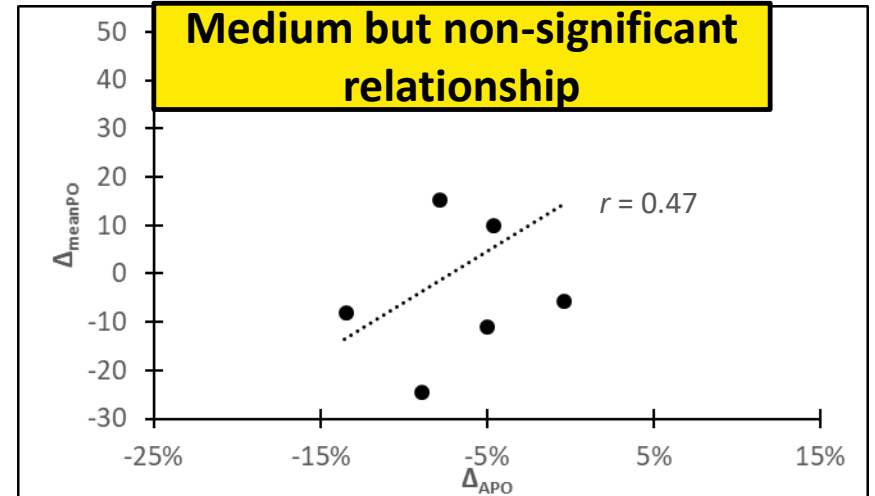
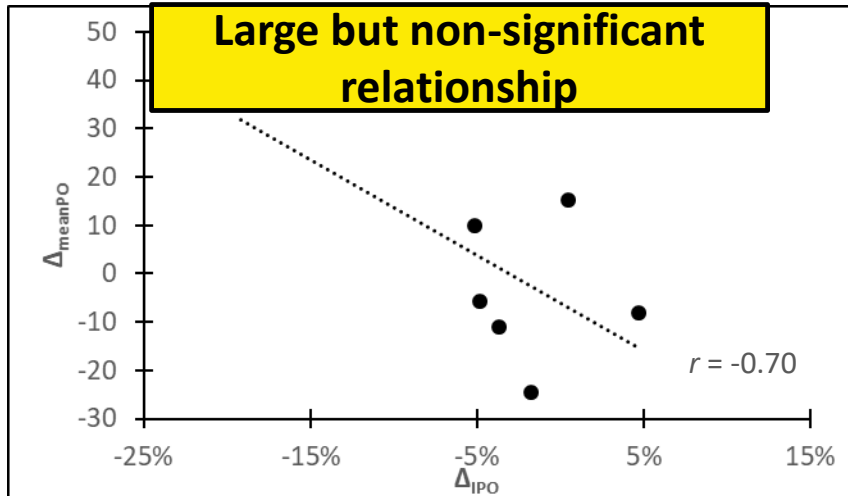
1 baseline cyclist (C2)

For each ITT:



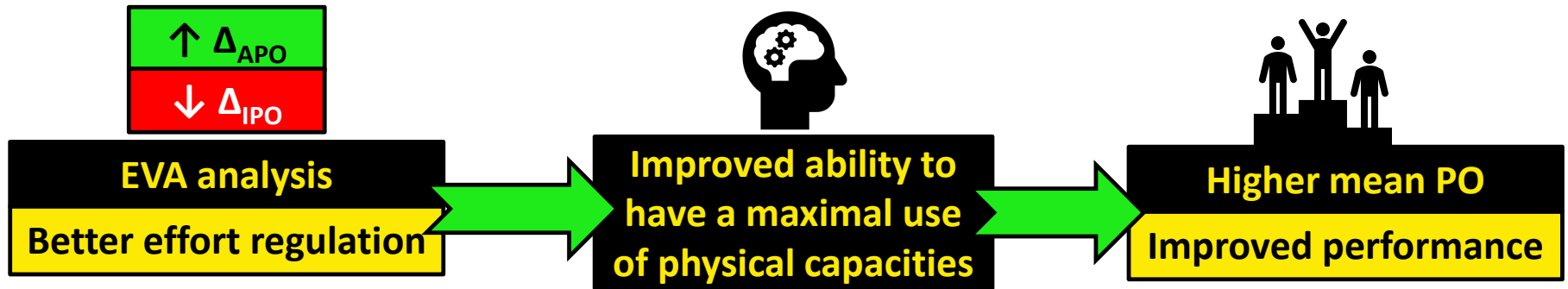
Pearson correlation coefficients to analyse relationship between $\Delta_{Mean PO}$ and $\Delta_{Mean PO\%}$ with Δ_{APO} , Δ_{IPO} and Δ_{REG}

RESULTS



DISCUSSION

EVA method to monitor pacing regulation and performance during ITT



Date	Race	Ranking	Mean PO	EVA analysis			
17/02	Andalucia-3	36 th	386 w	APO	—	IPO	+
14/03	Tirreno-Adriatico-7	17 th	412 w	APO	==	IPO	==
16/05	Giro d'Italia-10	19 th	377 w	APO	==	IPO	+
28/05	Giro d'Italia-21	4 th	421 w	APO	+	IPO	—

Monitor progress in pacing regulation during ITT

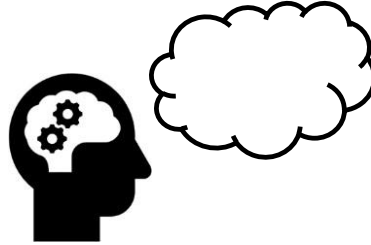
Propose explanations for bad performance in ITT

Test efficiency of training and psychological method to improve ability to optimally regulate pace during ITT

DISCUSSION

Psychological method to improve pacing regulation during ITT

Brick et al., 2014 ; Brick et al., 2016



Attentional focus

4 thoughts categories related to



Bodily sensations

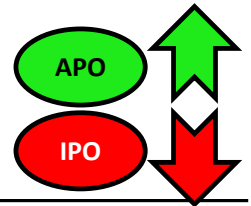
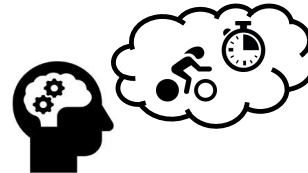
Movement control

Outward monitoring

Distraction

Decreasing RPE

Key information to regulate pacing strategy



**Optimizing pacing regulation
and ITT performance**

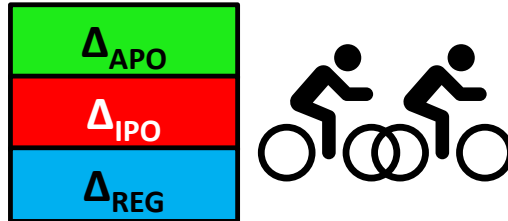
**Psychological interventions
Improved efficiency of
thoughts regulation**

**EVA
monitoring**

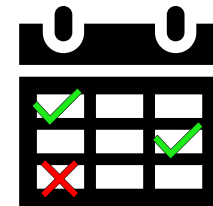
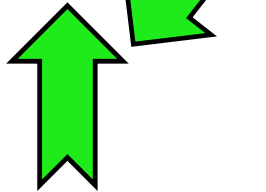
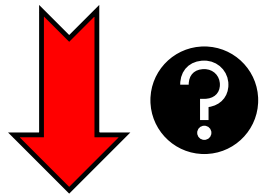


PERSPECTIVES

Main limit of the method



EVA indices calculated from differences between 2 cyclists



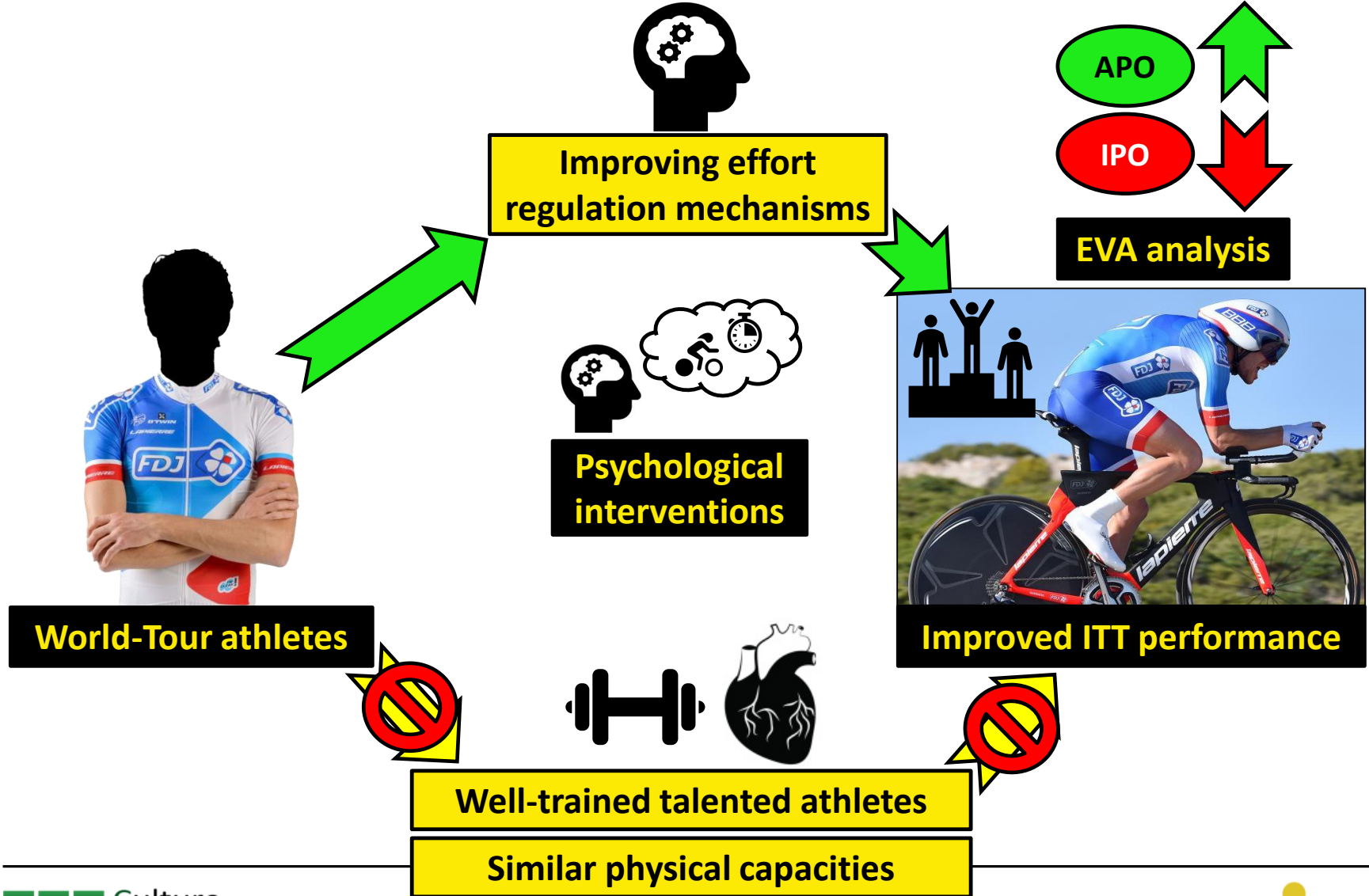
Is it cyclist 1 who decreased his performance or cyclist 2 who improved his performance

Same races performed by the 2 cyclists
Missing data for some ITT

Optimize method to obtain EVA baseline indices without comparing to another cyclist

CONCLUSION

How to improve ITT performance of World-Tour cyclists ?



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REFERENCES

- Abbiss CR & 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, & Laursen P** (2010). Examining pacing profiles in elite female road cyclists using exposure variation analysis. *Br J Sports Med* 44: 437-442
- Atkinson, G., & Brunskill, A.** (2000). Pacing strategies during a cycling time trial with simulated headwinds and tailwinds. *Ergonomics*, 43(10), 1449-1460. doi:10.1080/001401300750003899
- Brick, N. E., MacIntyre, T. E., & Campbell, M. J.** (2014). Attentional focus in endurance activity: new paradigms and future directions. *Int Rev Sport Exerc Psychol*, 7(1), 106-134.
- Brick, N. E., MacIntyre, T. E., & Campbell, M. J.** (2016). Thinking and Action: A Cognitive Perspective on Self-Regulation during Endurance Performance. *Front Physiol*, 7, 159. doi:10.3389/fphys.2016.00159
- Foster, C., Snyder, A. C., Thompson, N. N., Green, M. A., Foley, M., & Schrager, M.** (1993). Effect of pacing strategy on cycle time trial performance. *Med Sci Sports Exerc*, 25(3), 383-388.
- Marcora, S. M., & Staiano, W.** (2010). The limit to exercise tolerance in humans: mind over muscle? *Eur J Appl Physiol*, 109(4), 763-770. doi:10.1007/s00421-010-1418-6
- Mathiassen SE, & Winkel J** (1991). Quantifying variation in physical load using exposure-vs-time data. *Ergonomics*, 34(12), 1455-1468.
- Ouvrard, T., Pinot, J., Gros Lambert, A., & Grappe, F.** (2017). Exposure Variation Analysis (EVA) method to monitor ability to optimally regulate exercise intensity of professional cyclists during time-trial competitions. *Journal of Science and Cycling*, 6(3).
- St Clair Gibson, A., Swart, J., & Tucker, R.** (2017). The interaction of psychological and physiological homeostatic drives and role of general control principles in the regulation of physiological systems, exercise and the fatigue process – The Integrative Governor theory. *European Journal of Sport Science*, 1-12. doi:10.1080/17461391.2017.1321688
- 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



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