EUROPEAN ATHLETICS
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Regulation of performance during endurance competition

Dr Andy Renfree
Principal Lecturer in Sport & Exercise Science
University of Worcester
United Kingdom
WR2 6JA
a.renfree@worc.ac.uk

Who am I?

Currently Principal Lecturer in Sport & Exercise Science at University of Worcester, UK.

PhD – determinants of Pacing decisions during self-paced competitive endurance activity.

Athletic ‘career’:

3m44s – 1500m

2 x Scottish Champion

7th British Championship

Thanks to my colleagues

Prof Zig St Clair Gibson (University of Hull)

Dr Clare Rhoden (University of Worcester)
Dr Louise Martin
Prof Derek Peters

Dr Dominick Micklewright (University of Essex)

Dr Everton Crivoi (Senac, Sao Paulo)

Dr Brian Hanley (Leeds Beckett University)

Dr Arturo Casado (Madrid)

Dr Jose Joaquin Diaz (University of Seville)

Fatigue is the Problem

Origins of fatigue can be central or peripheral in origin.

However, a useful **functional** definition is “the inability to maintain a desired or expected power output” (Edwards 1983)

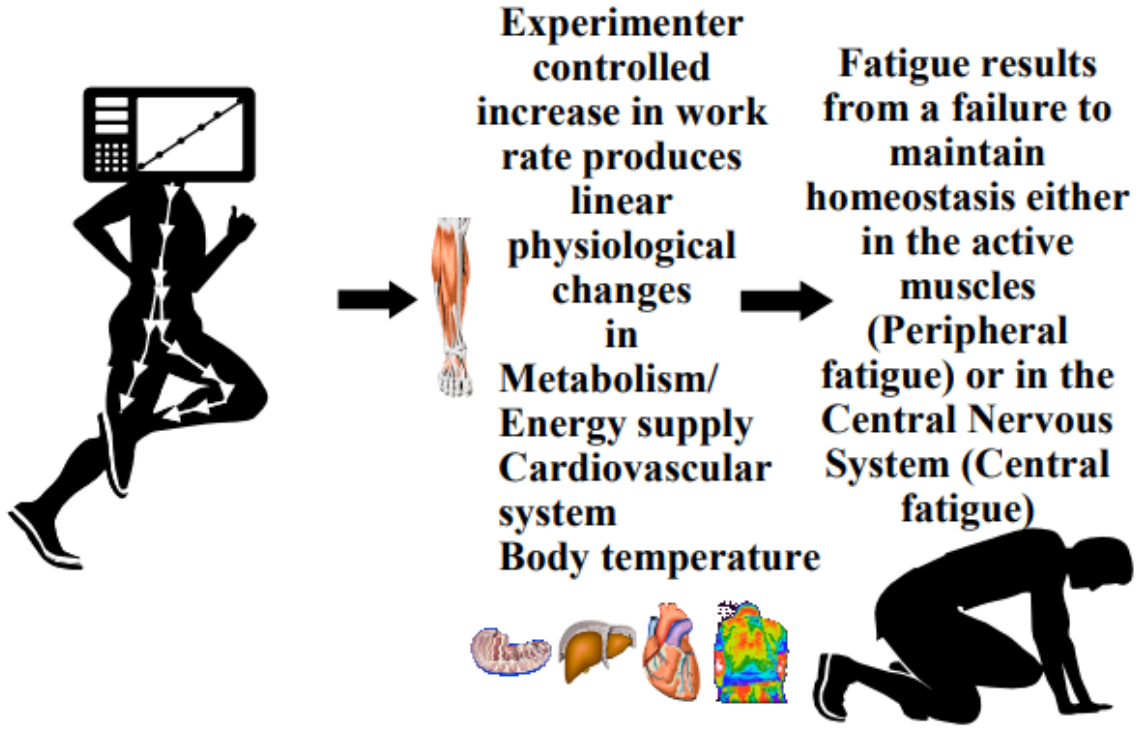
Some of the things that can ‘go wrong’:

Low pH, glycogen depletion, dehydration, hyperthermia, ion fluxes, mechanical damage, reduced motivation etc etc…

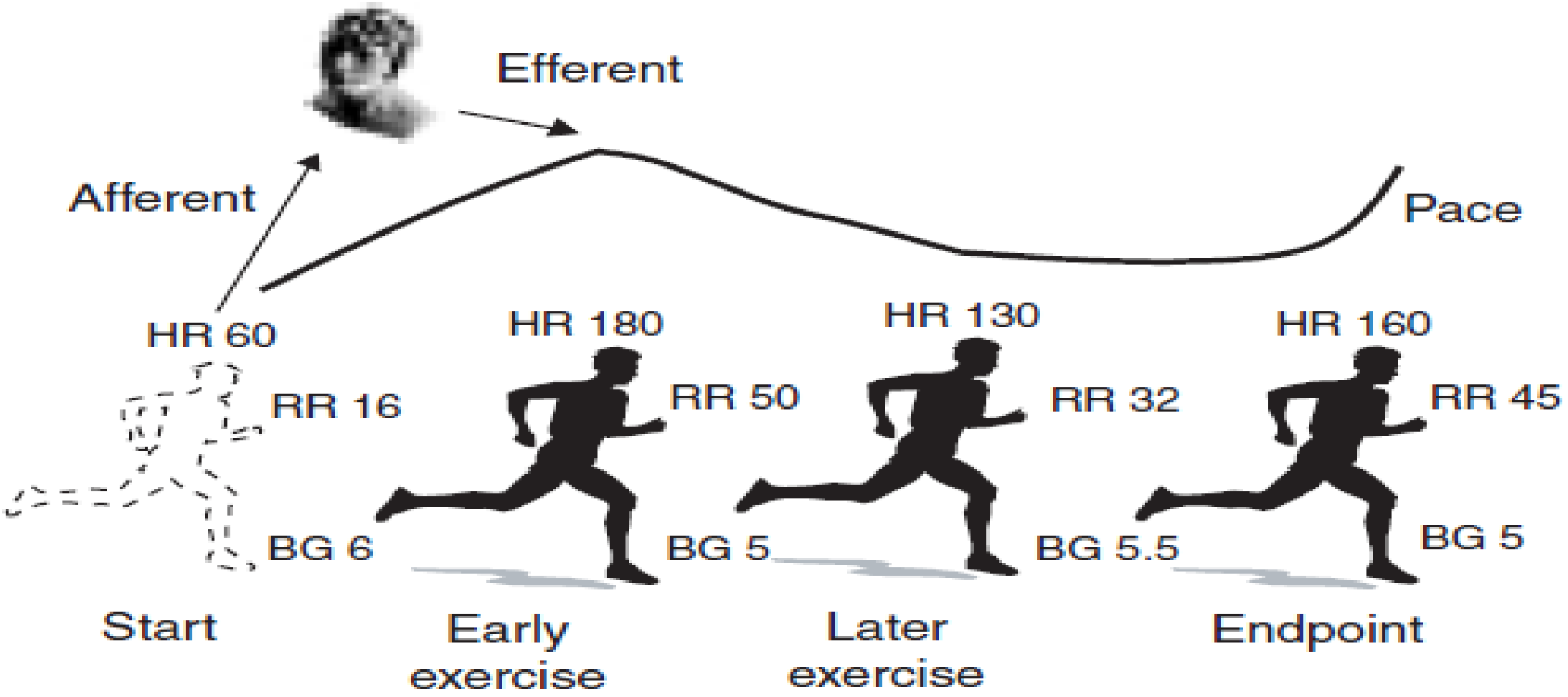
Review

British Journal of
Sports Medicine
Latest content Current Issue Archive A

Testing for maximum oxygen consumption has produced a brainless model of human exercise performance

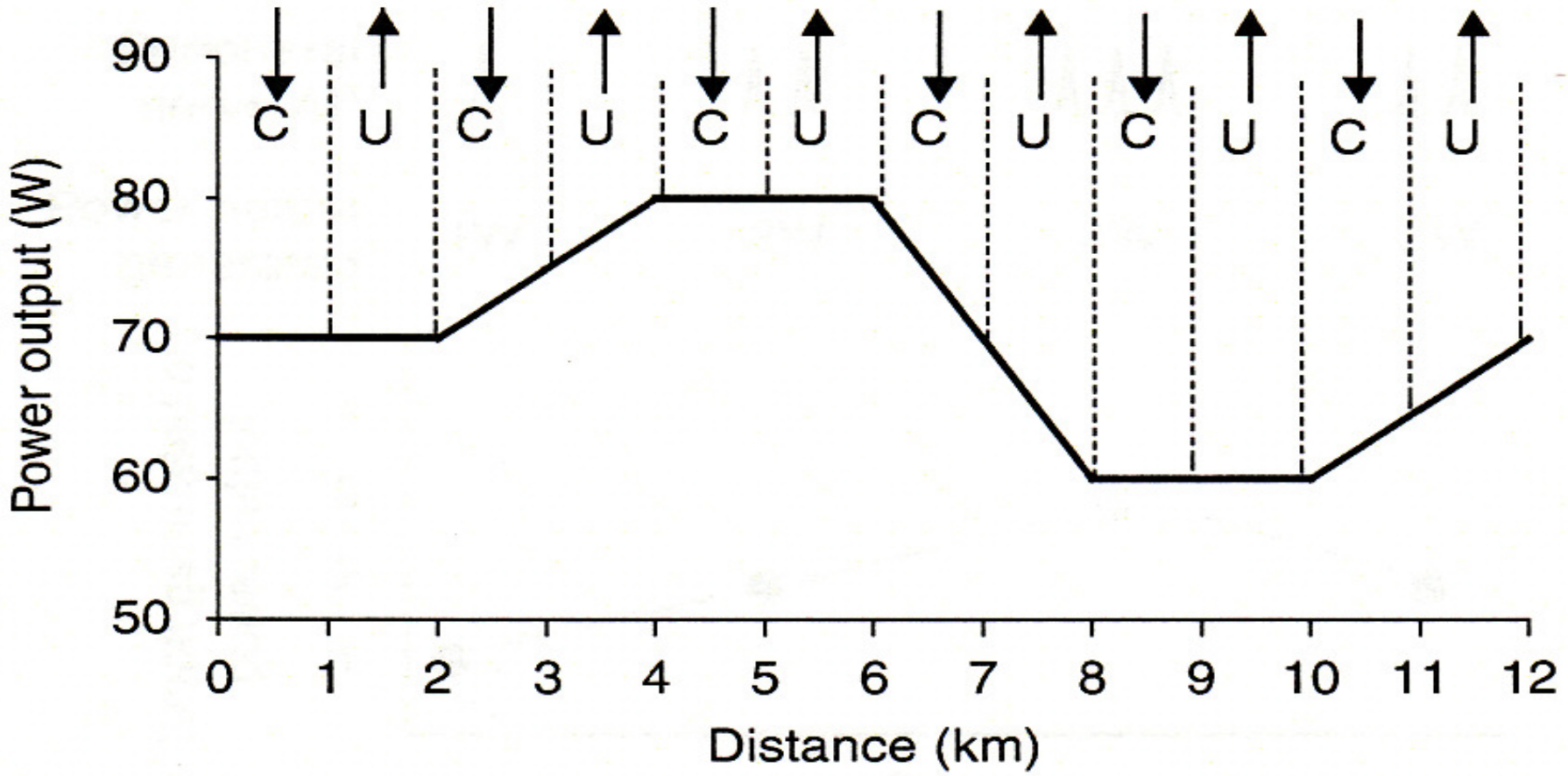


Teleoanticipation



St Clair Gibson et al. 2006

Teleoanticipation



St Clair Gibson et al. 2006

Regulation is required to address tension between the 'mind' and the 'body'

Goal achievement

Avoidance of catastrophic physiological failure

St Clair Gibson et al. 2018

Prevent catastrophic physiological failure

Goal setting is a necessity

Goal achievement is facilitated through identification of a strategy

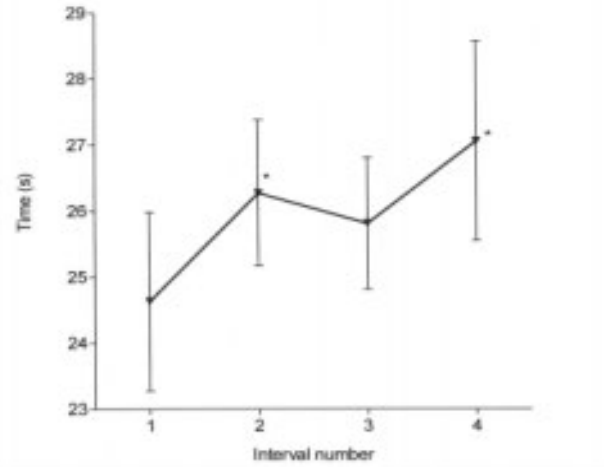


Figure 2 — 200-m interval times from 12 world-record performances in the 800-m. Values are mean ± SD for 12 performances. *Significantly different from intervals 1 and 3 ($P < .05$).

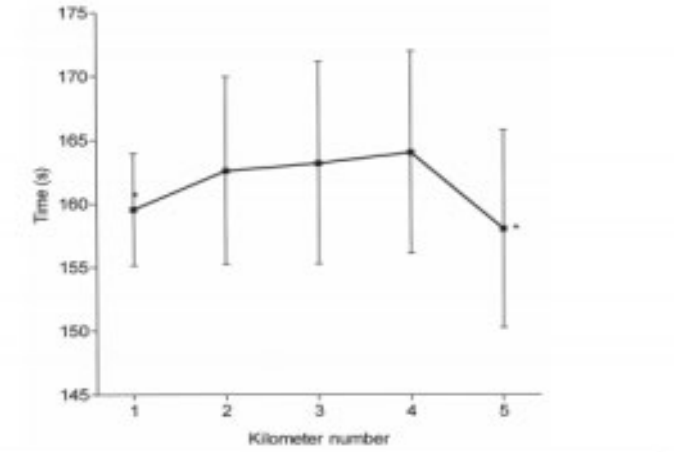


Figure 3 — Kilometer times from 32 world-record performances in the 5000-m event. Values are mean ± SD for 32 performances. *Significantly different from kilometers 2, 3, and 4 ($P < .005$).

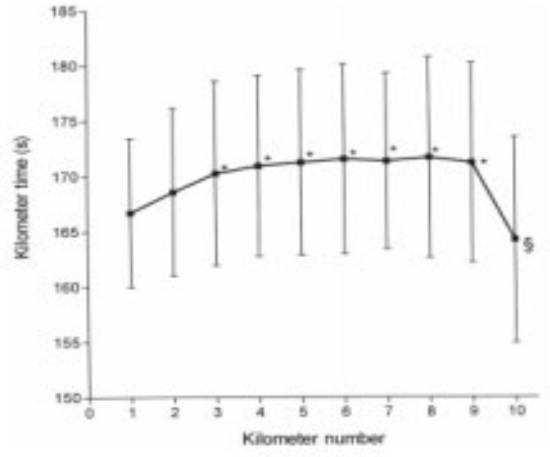


Figure 4 — Kilometer times from 34 world-record performances in the 10,000-m event. Values are mean ± SD for 34 performances. *Significantly slower than kilometers 1, 2, and 10 ($P < .05$). §Significantly faster than the preceding 9 km ($P < .005$).

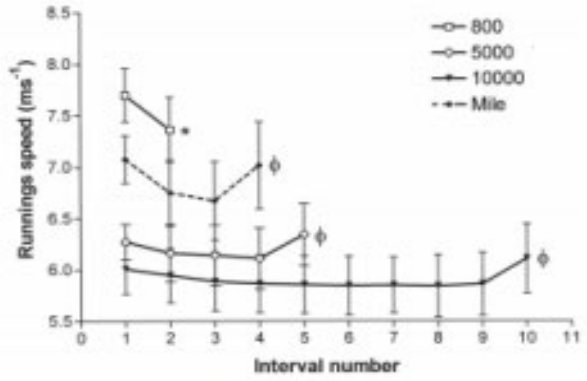
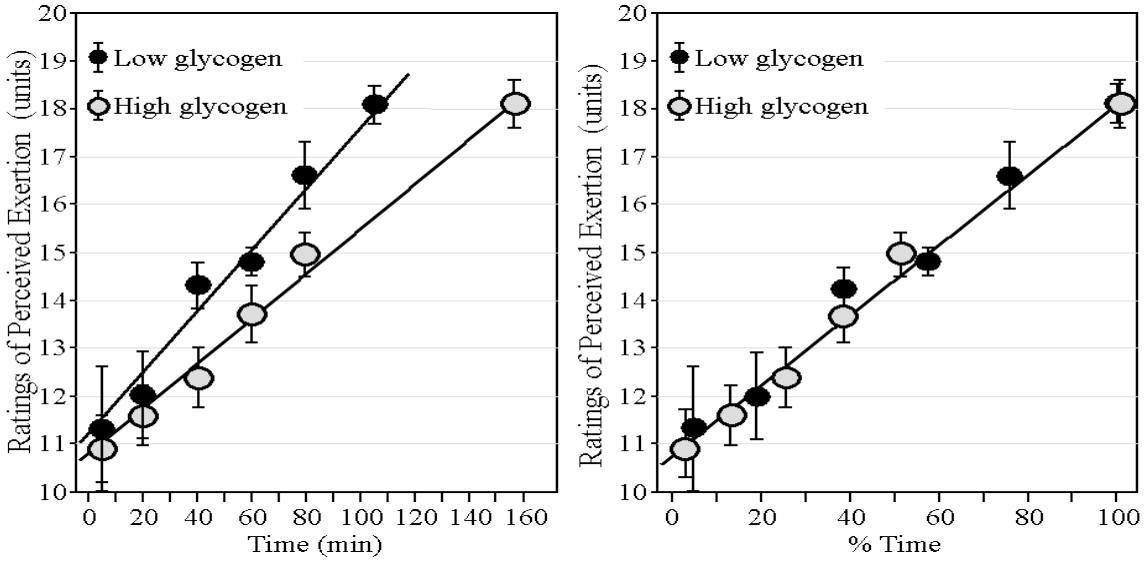


Figure 5 — Average running speed for each interval during world-record performances in 800-m, 1-mile, 5000-m, and 10,000-m events. The running speeds for the mile event are shown with a dashed line (from Noakes and Lambert, in review). *Significantly slower than the first lap ($P < .005$). ΦSignificantly faster than preceding intervals.

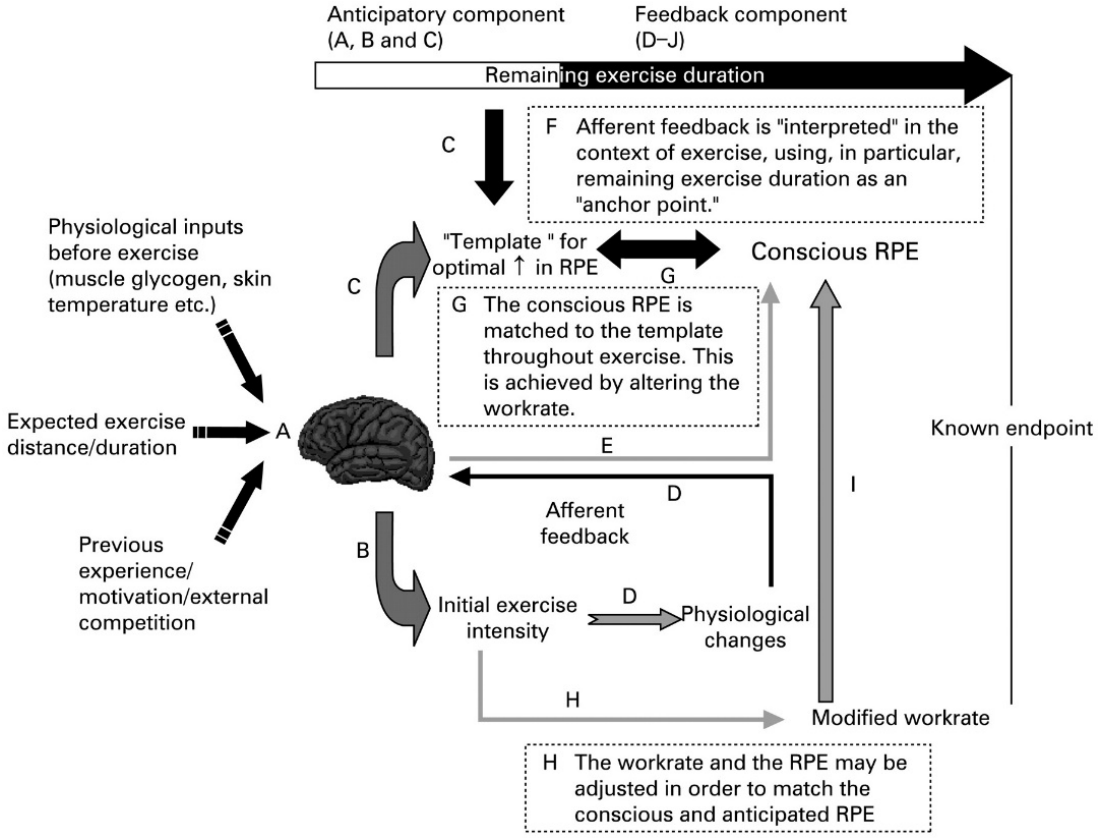
(Tucker 2006)

Plans rarely work out as intended

RPE has been suggested to be the 'controller'

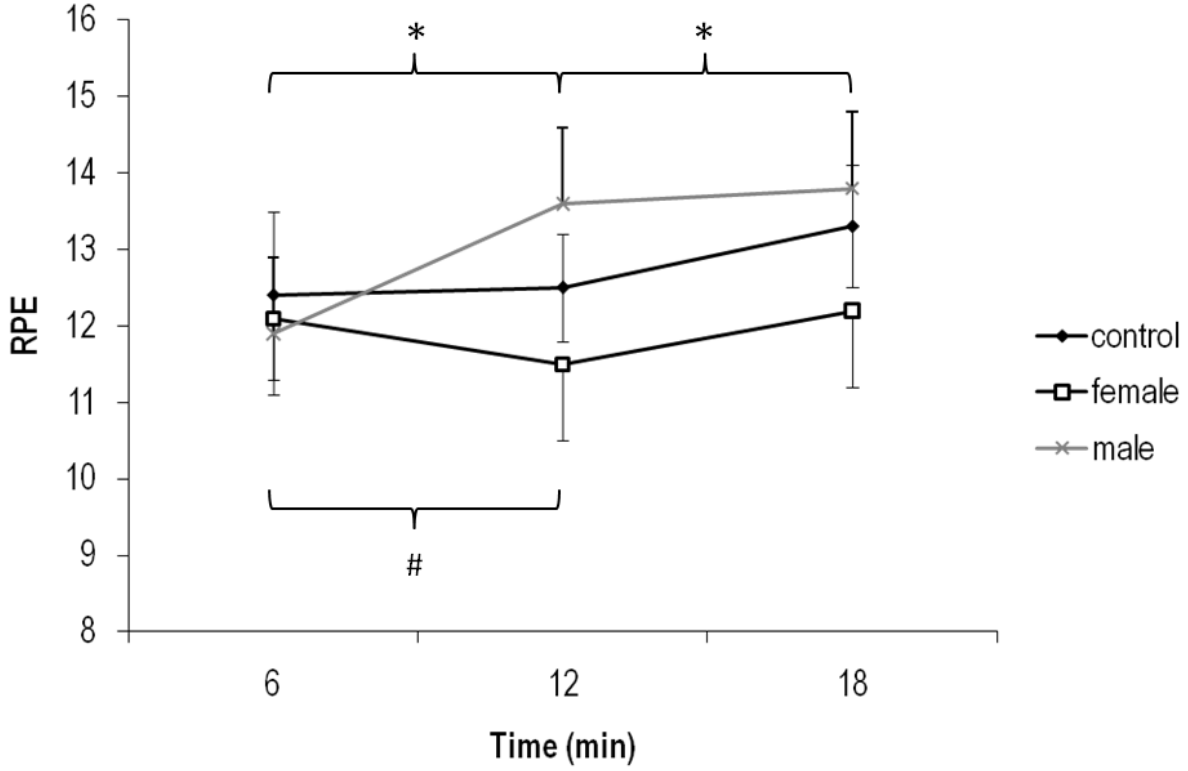


Noakes 2004

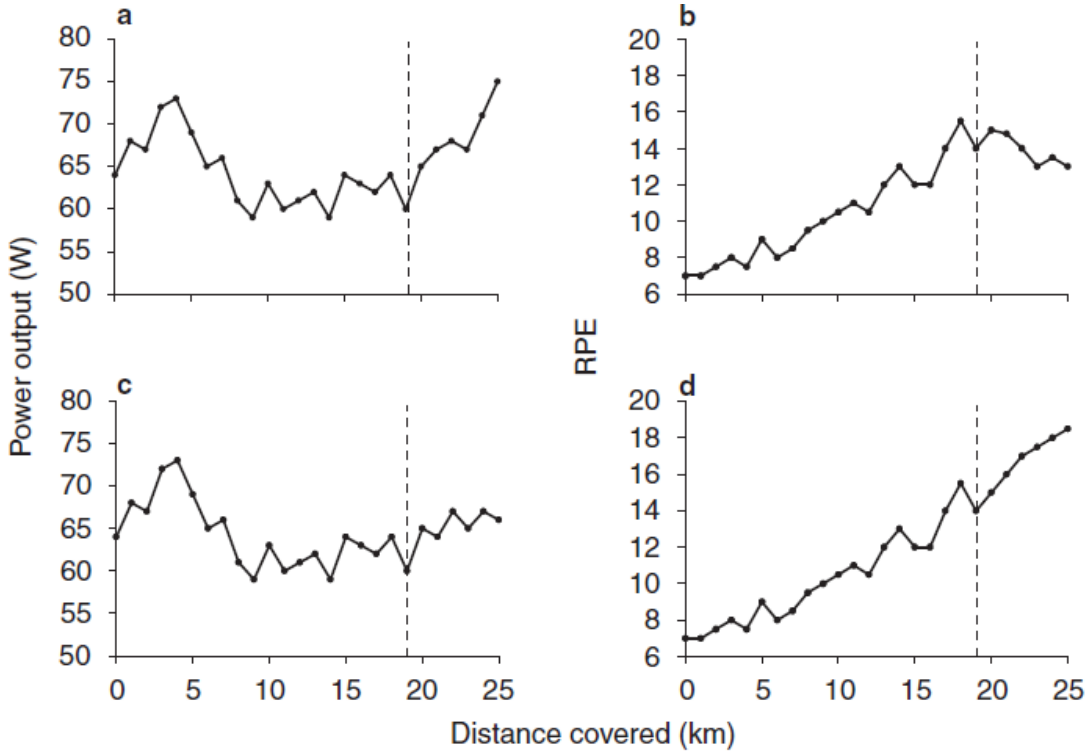


Tucker 2009

But RPE is easily dissociated from physiological variables



Winchester et al. 2010



St Clair Gibson et al. 2006

Models of decision-making

Decision-making is the process of making a choice from a set of options where the consequences of that choice are crucial (Bar Eli et al 2001).

Rational Decision Making (Simon 1955) requires certain criteria to be met:

- the individual must be faced with a set of behaviour alternatives.
- the individual must have access information relating to all possible outcomes of the choices made.

Such decision-making behaviour place severe demands on cognitive processing abilities. As such, effective rational decision making can only occur in 'Small World' environments where the decision maker has perfect knowledge of all relevant behaviour alternatives, consequences, and probabilities

Models of decision-making *cont'd*

Heuristic decision-making considers only a limited fraction of available information.

Heuristics may be the preferred method of decision-making in situations where the outcome of actions cannot be calculated with confidence (Gigerenzer & Gaissmaier 2011). Heuristics therefore place lesser demands on individuals.

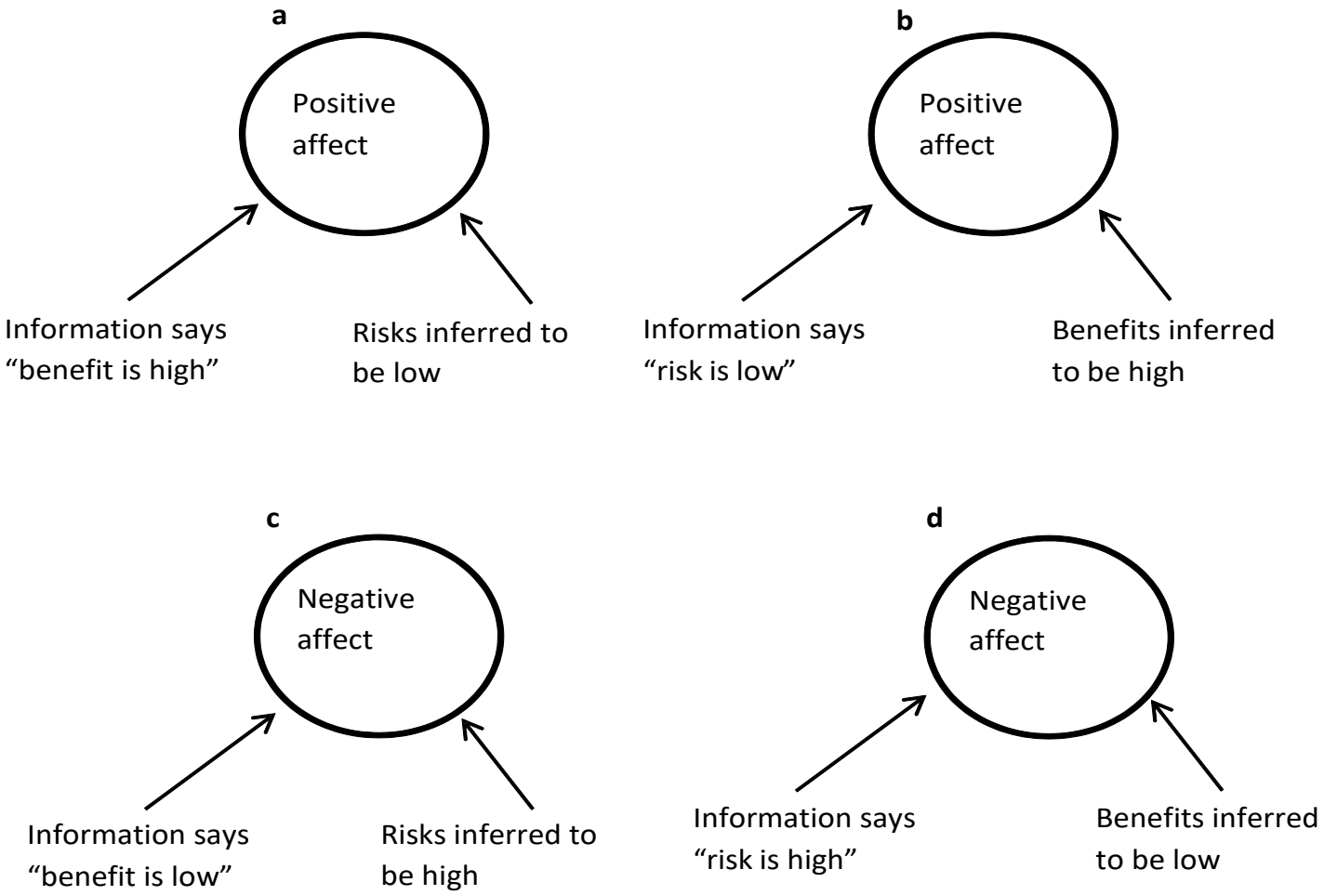
In contrast to the theoretical small world environments described previously, "large worlds" exist where some relevant information is unknown or estimated.

In such environments, rational decision-making is not possible.

Table 1

Rational decision-making	The process of making decisions based upon complete knowledge of the available behaviour options and the statistical probability of specific outcomes occurring. Places high demands on the cognitive processing capacity of an individual.
Heuristic decision-making	A strategy that ignores some available information to make decisions more quickly and or accurately than can be achieved through more complex methods. Heuristics may be considered 'rules of thumb' or 'gut instincts'. Places low demands on the cognitive processing capacity of an individual.
Small world environments	Environments in which the decision maker has perfect knowledge of all behaviour alternatives, consequences, and probabilities
Large world environments	Environments where some relevant information is unknown or estimated

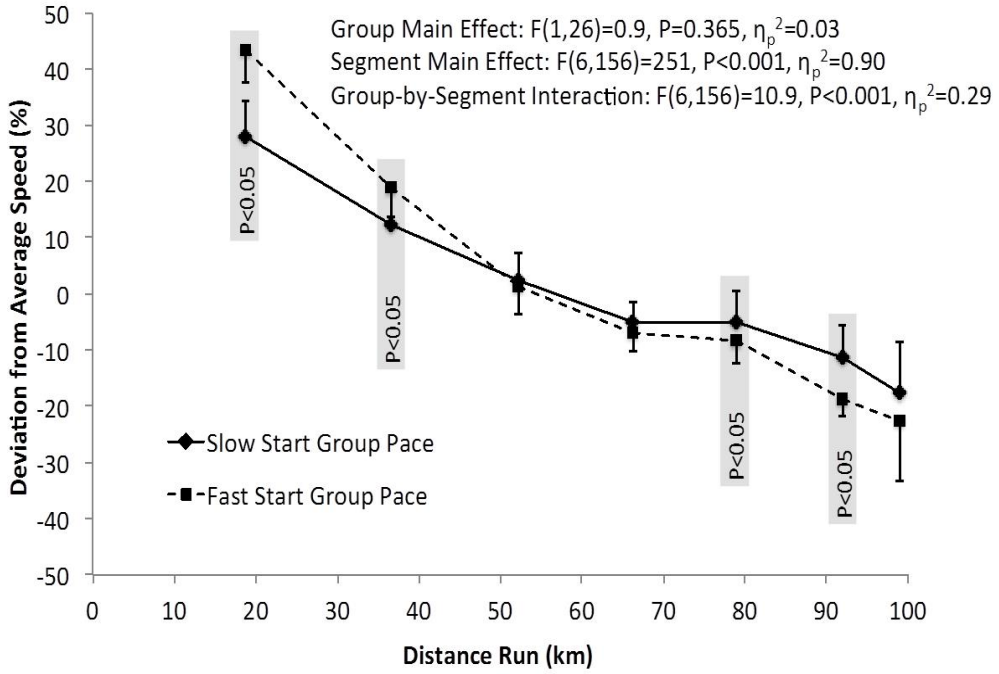
Renfree et al. 2014

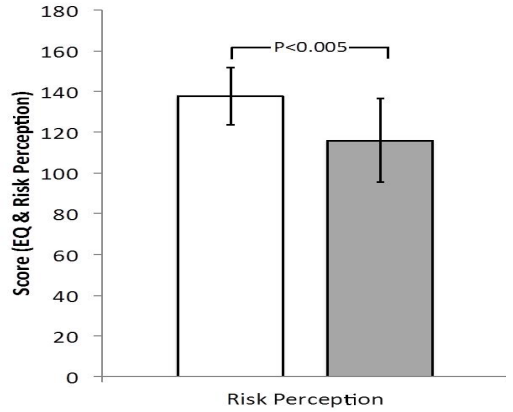


Use of an overall affective impression is more efficient than rational analysis, especially when the decision to be made is complex or mental resources are limited (Slovic et al 2003)

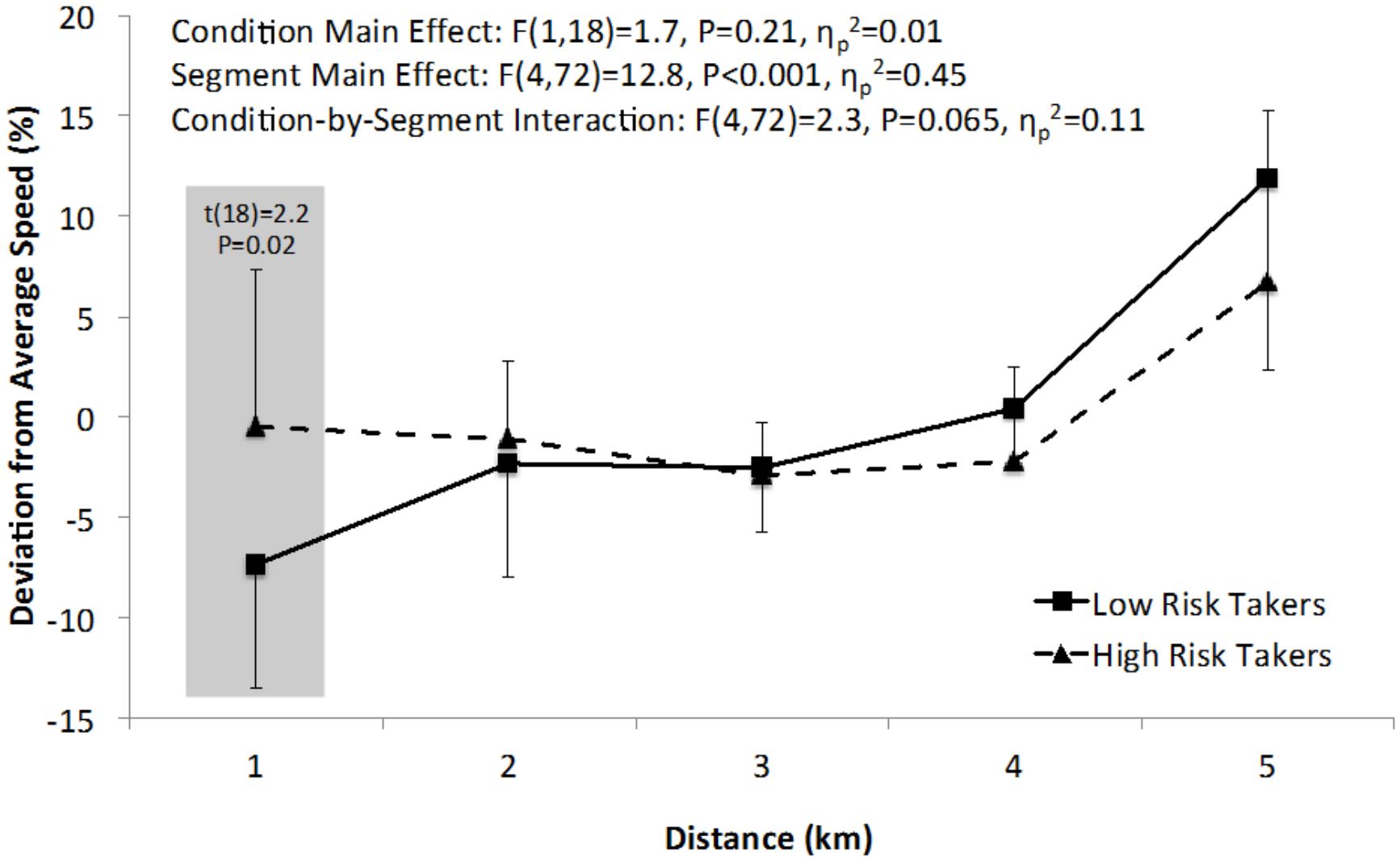
Renfree et al. 2014

Assessment of risk may be important





Micklewright et al. 2014



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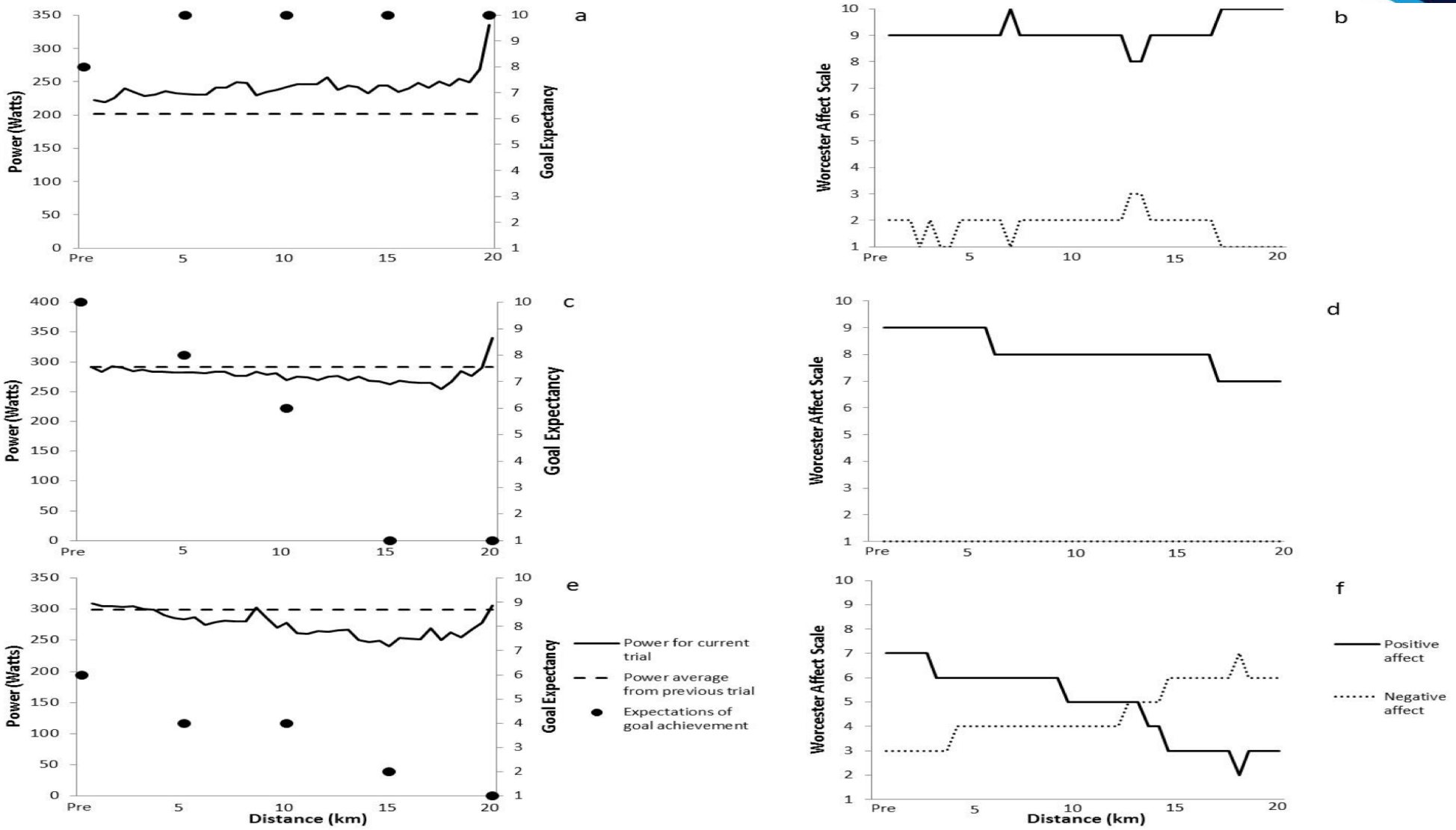
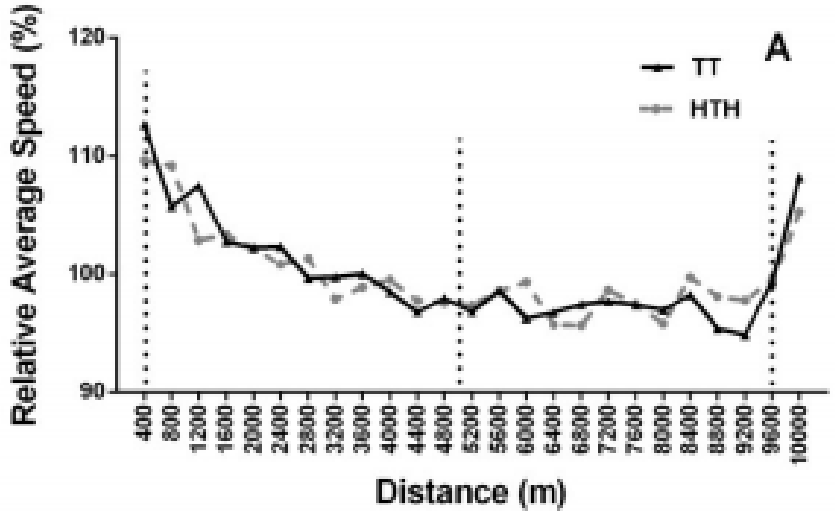
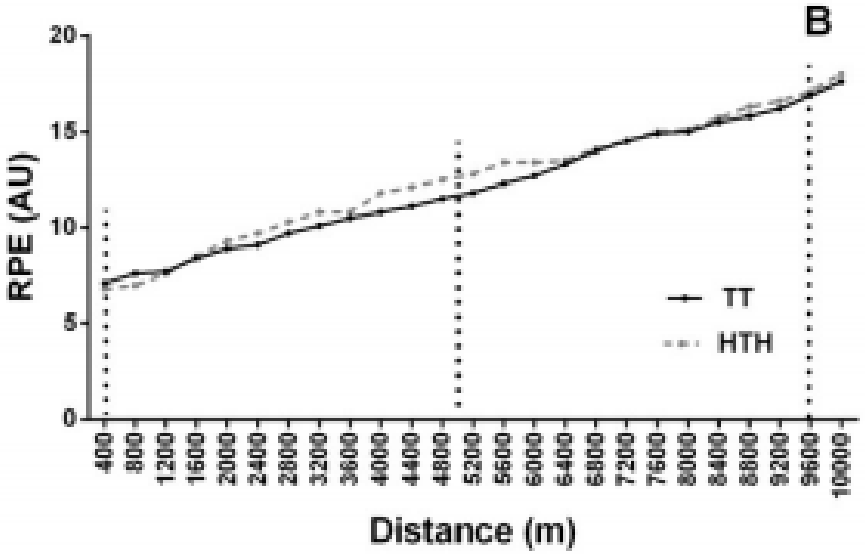
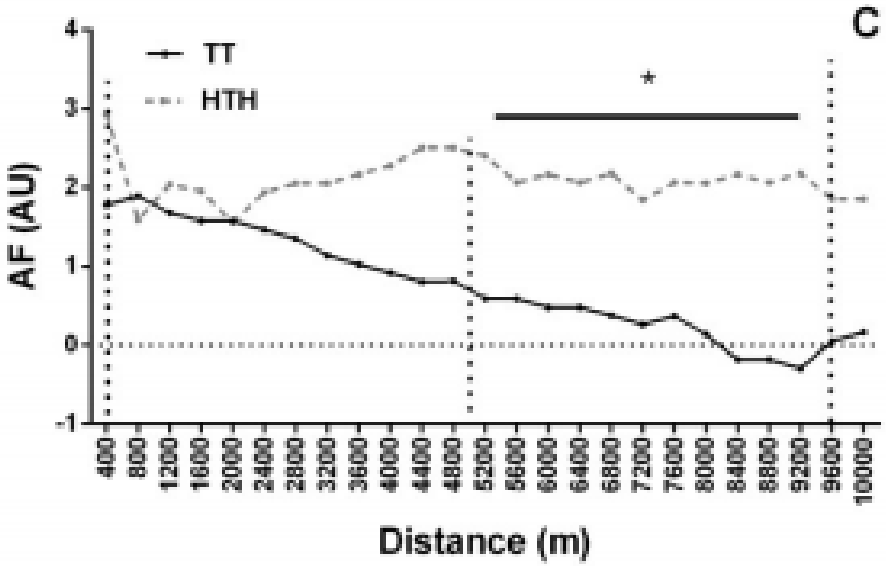


Rhoden et al. 2015

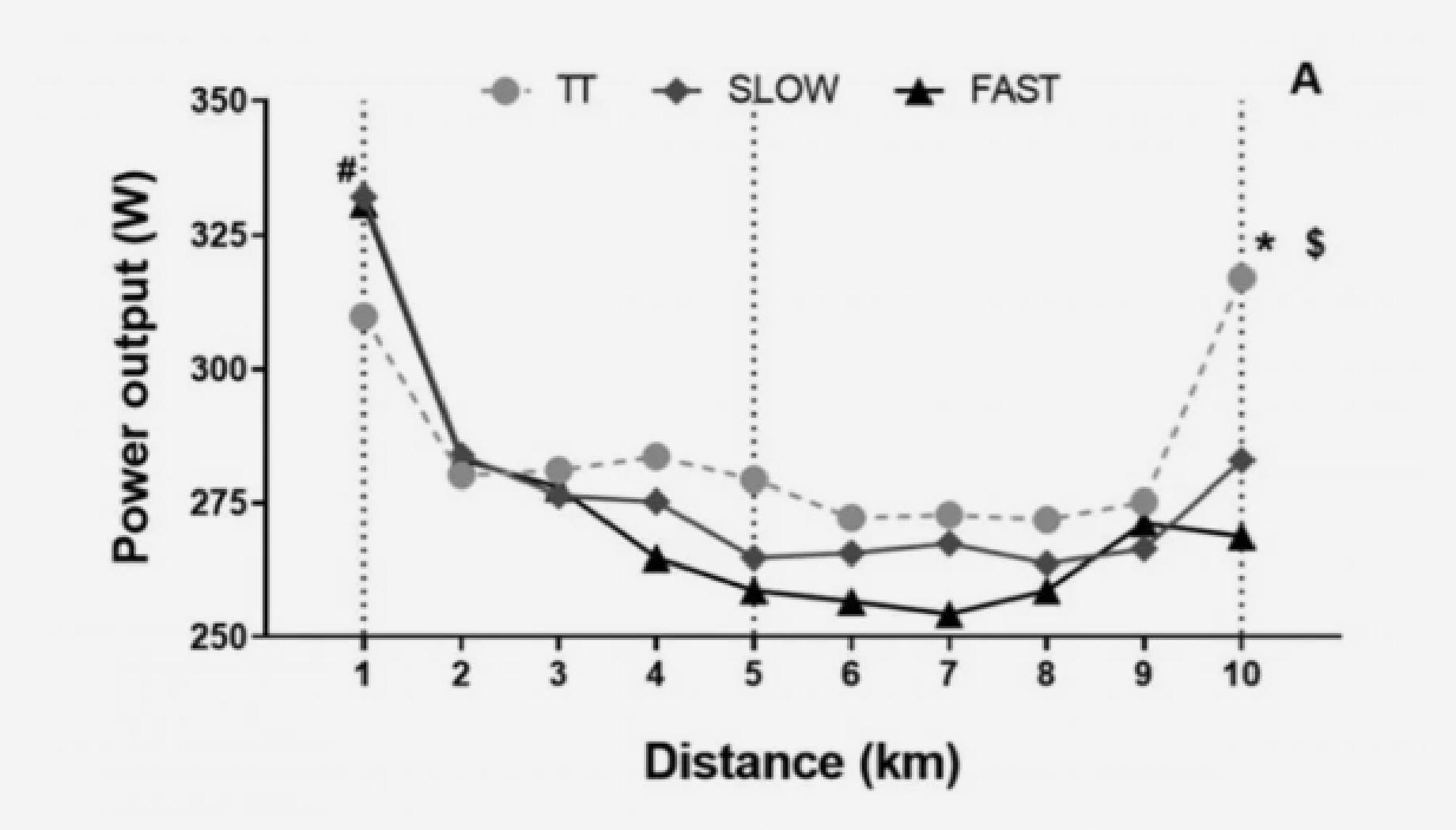




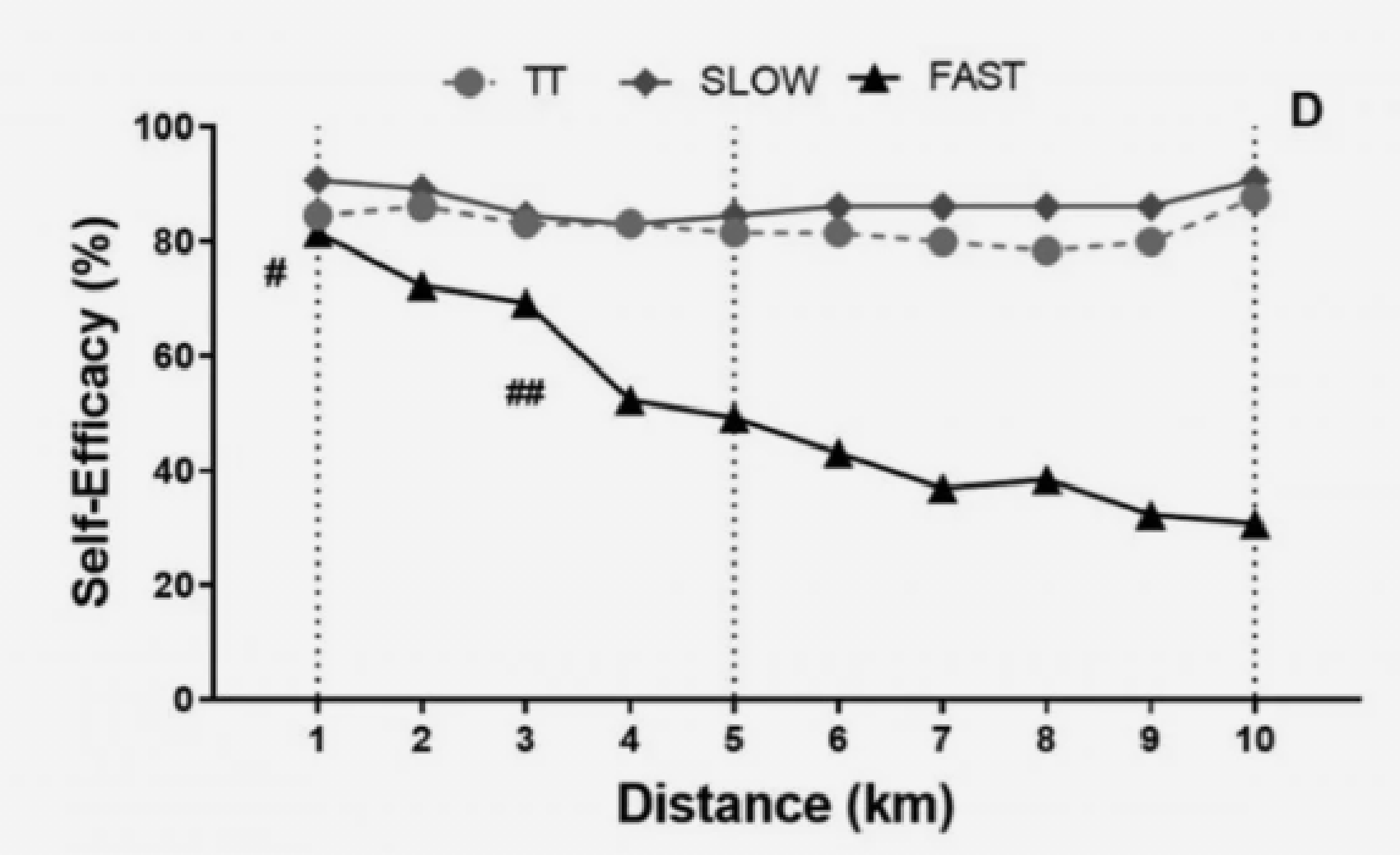


Crivoi et al. 2019

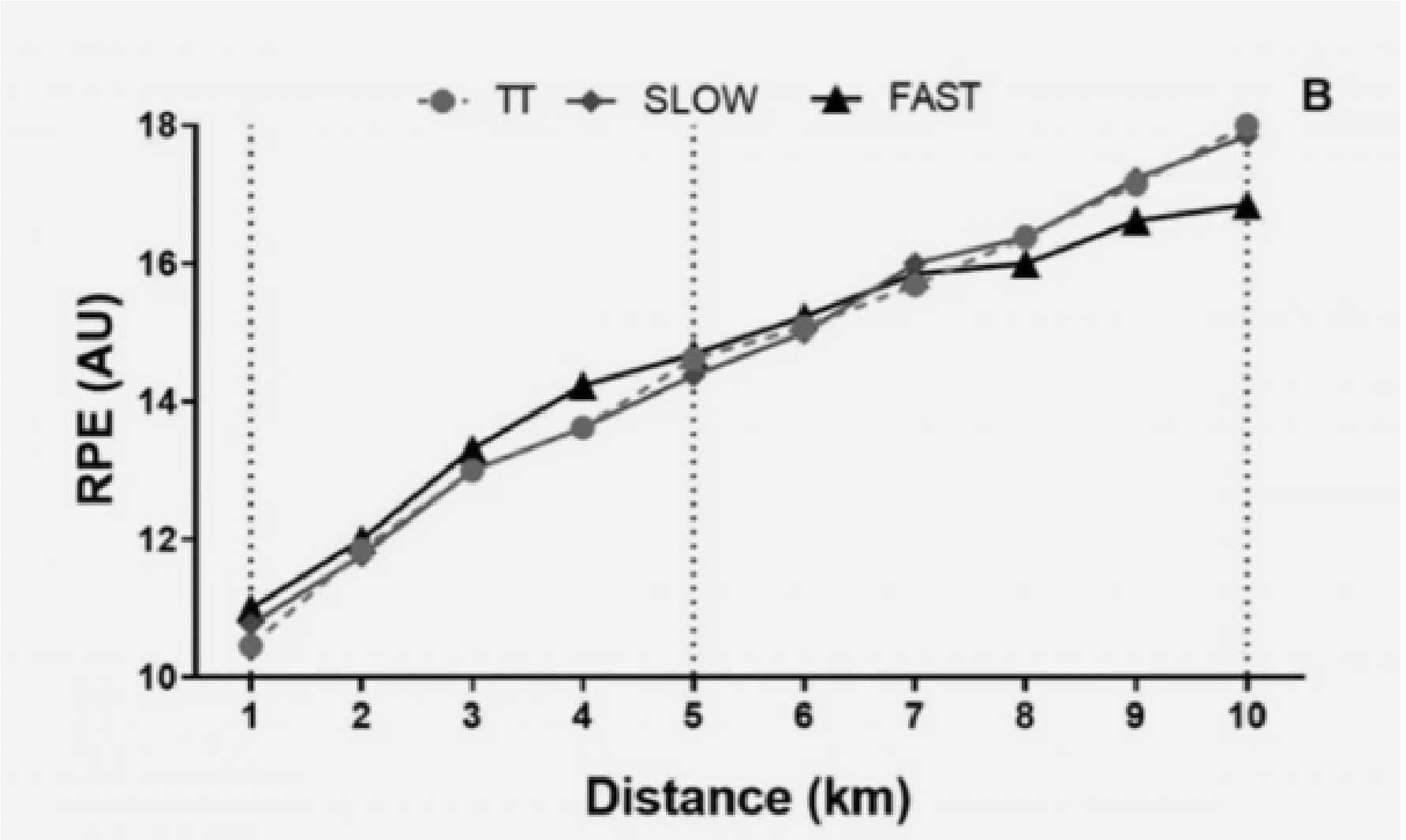
Like knitting with spaghetti!



Crivoi et al. 2021

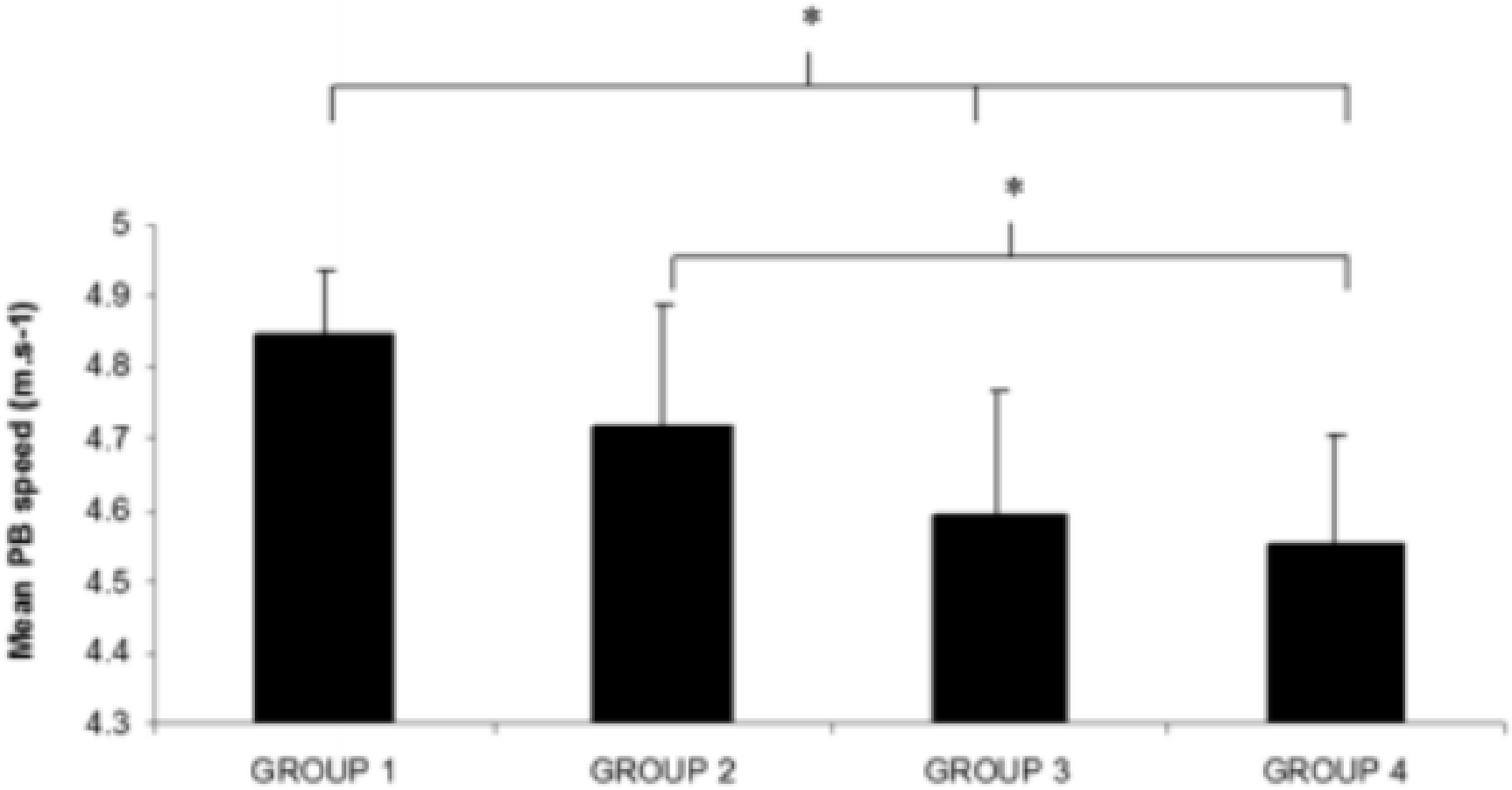


Crivoi et al. 2021



Crivoi et al. 2021

Do all competitors do the same?



Renfree & St Clair Gibson 2013

Do all competitors do the same?

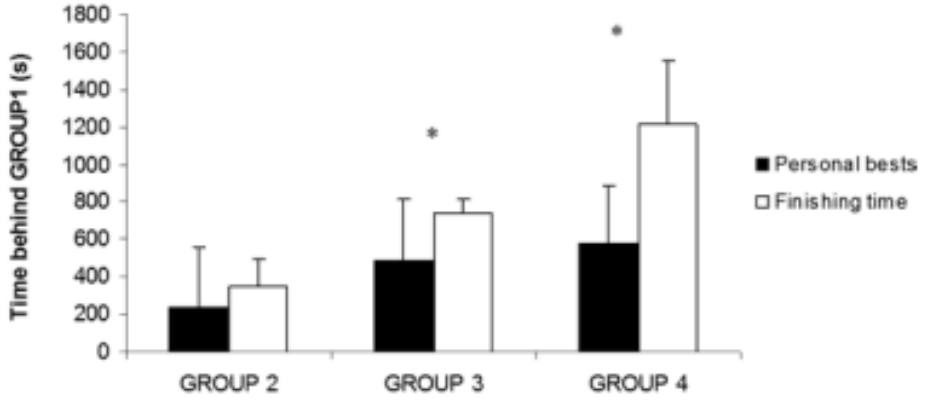


Figure 2 — Time behind personal best and finishing time of group 1 athletes for groups 2–4. *Significant difference between personal best and finishing times behind group 1 ($P < .01$).

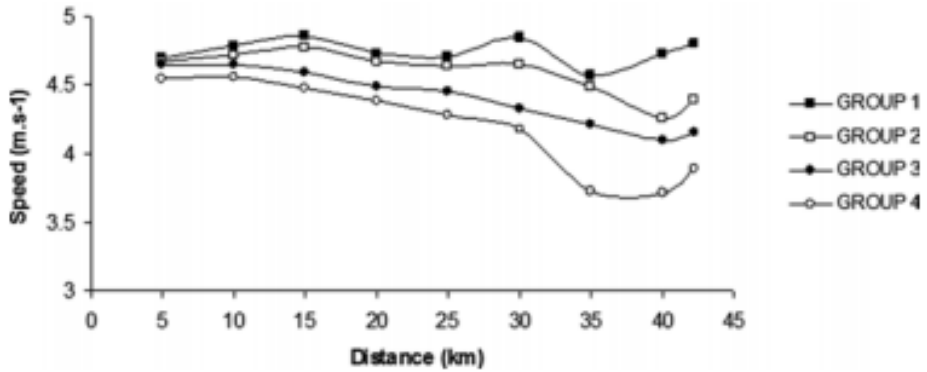


Figure 3 — Mean running speed in each intermediate 5-km segment (error bars and statistical significance removed for clarity).

Renfree & St Clair Gibson 2013

Do all competitors do the same?

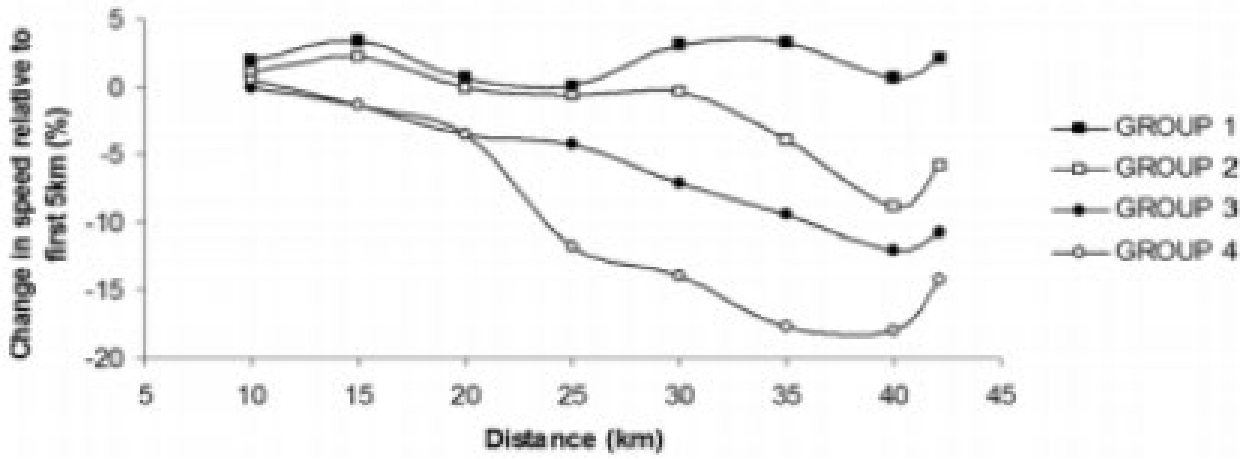


Figure 5 — Changes in speed relative to initial 5 km (error bars and statistical significance removed for clarity).

Renfree & St Clair Gibson 2013

PERSPECTIVE ARTICLE
Front. Physiol., 09 December 2015 | https://doi.org/10.3389/fphys.2015.00373

The Influence of Collective Behavior on Pacing in Endurance Competitions

Andrew Renfree[1]*, Everton Crivoi do Carmo[2], Louise Martin[1] and Derek M. Peters[1,3]

[1]Institute of Sport and Exercise Science, University of Worcester, Worcester, UK
[2]Department of Physical Education, Senac University Centre, Sao Paulo, Brazil
[3]Faculty of Health and Sport Sciences, University of Agder, Kristiansand, Norway

EDITED BY
Julien Périard
University of Canberra, Australia

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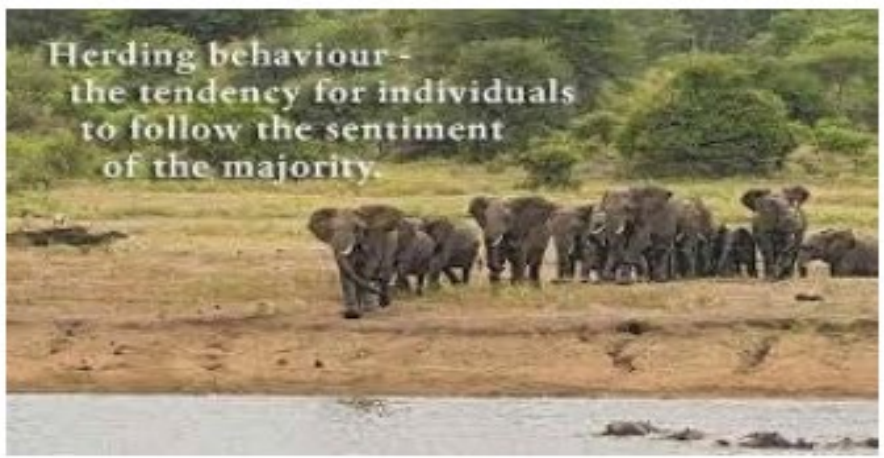

Experimental evidence that opponents influence pacing decisions

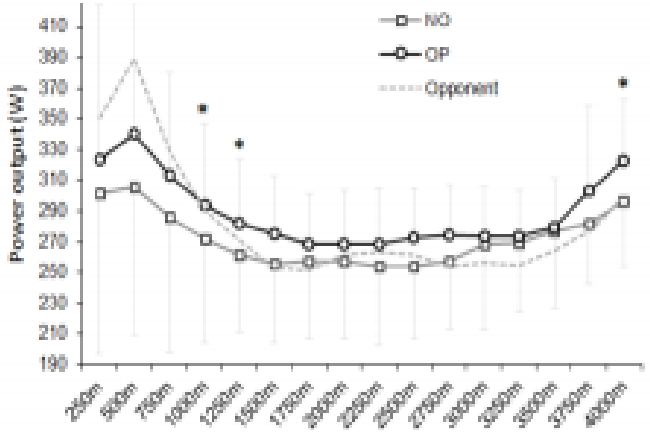

Figure 1. Average power output per 250 m segment for both experimental conditions. In addition, the average power output per 250 segment of the virtual opponent in the experimental condition OP is displayed.
* significant difference between OP and NO (P<0.05)

Table 2. Mean ± SD values for the neuromuscular function of the knee extensors in terms of maximal voluntary contraction force (MVC), potentiated doublet-twitch force (PT) and voluntary activation (VA) before and after both 4 km time trial conditions.

	NO			OP		
	Pre-TT	Post-TT	Decrease%	Pre-TT	Post-TT	Decrease%
MVC [A,B] (N)	715±182	633±169	11.4±10.9	717±199	592±170	17.5±12.4
PT [A,B] (N)	425±70	356±83	16.2±11.4	431±83	331±75	23.1±14.0
VA [A] (%)	80.2±9.8	76.7±8.1	3.4±5.0	83.0±8.8	78.1±11.8	4.9±6.7

[A] main effect for Trial (pre vs post), [B] interaction effect for Trial*Condition

Konings et al. 2018

In summary

- Management of exercise intensity is regulated by the brain.
- Exactly how pacing decisions are made is uncertain, although both RPE and affect are implicated.
- Goal setting is of crucial importance.
- Goal achievement requires strategic planning.
- (Perceived) progress towards a goal is important and may result in modifications to strategy.
- Presence of opponents heavily influences pacing decisions.

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Thank you!

Dr Andy Renfree
Principal Lecturer in Sport &
Exercise Science
University of Worcester
United Kingdom
WR2 6JA
a.renfree@worc.ac.uk

@andyrenfree

University of Worcester