BOOK OF ABSTRACTS Open Access

The process of losing – investigating the psychophysiological determinants of pacing and performance during head-to-head competition

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Introduction

It is widely accepted that psychological factors can greatly influence human endurance and strength performance. However, little is known about the mechanisms that underpin facilitative and even more so debilitative cause-effect relationships between psychological factors and endurance performance during competition.[1] We recently developed a three-dimensional framework of centrally-regulated and goal-directed exercise behaviour emphasizing the important role of sensory-discriminatory, affective-motivational, and cognitive-evaluative processes underpinning observed pacing behaviour and performance.[2] The proposed framework offers a more sophisticated alternative to the traditional gestalt concept of perceived exertion in the investigation of the psychophysiological determinants of pacing and performance during prolonged endurance exercise. One aim of this experimental study was to examine the delineated contributions of the perceptual sensory, affective, and cognitive processes and their dynamic responses to respectively pulling ahead or falling behind a performance matched opponent.[3]

Methods

Fourteen maximal head-to-head competition time trials between well-trained performance matched cyclists (average time difference in individual time trial performance: 0.92%) over a 70 km virtual profiled course were conducted. The sensory, affective, and cognitive processes were approximated by means of scales: perceived physical (p-RPE) and mental strain (TEA), affective valence (FS) and felt arousal (FAS), and perceived action crisis (ACRISS), respectively. The dynamic changes in these constructs and their interrelationships with pacing behaviour, performance, and markers of metabolic and endocrinological distress were investigated. A five-step structural equation modelling procedure was applied to test the extent to which the observed data fit the hypothesized temporally linked cause-effect relationships unfolding in response to falling-behind a performance matched opponent. [4]

Results

Meaningful performance improvements of 2.24% (99.7% most likely substantially positive) and decrements 1.69% (82.4% likely substantially negative) were found in winners and losers, respectively. Perceived physical and mental strain scaled with time and according to course profile in winners and loser alike. The following significant interaction effects were found: losers showed deterioration in valence ($p=0.004$), experienced the development of an action crisis ($p<0.001$), showed increased blood cortisol concentrations ($p=0.001$), and performance decrement relative to individual's performance capabilities ($p=0.001$) (see figure 1). The dynamic change in valence was a significant mediator ($p=0.011$) in performance regulation as it explained 35% of the relationship between falling behind and action crisis. The shift from an implemental to a deliberative mindset associated with an action crisis was a significant predictor of exacerbated psycho-neuro-endocrinological distress response ($p=0.024$) and non-adaptive endocrinological distress response subsequently predicted relative performance decrement ($p=0.023$). The observed data fitted the hypothesized model well with excellent model fit indices throughout.

Conclusions

We applied, tested, and confirmed the hypothesized debilitative psychophysiological processes that unfold in response to falling behind a performance matched opponent. The main findings were: a) perceived physical and mental strain play primary roles in the teleoanticipatory pacing algorithm necessary to align planned behaviour with current physiological state; but both can be distorted by centrally-acting affective and cognitive modifiers, b) deterioration in non-reflective valence mediated the relationship between falling behind and reflective action crisis, c) the mindset-shift associated with an action crisis predicted exacerbated blood cortisol concentrations, and d) non-adaptive blood cortisol concentrations predicted

Figure 1. Dynamic changes in major study variables and differential responses between the winners and losers of a simulated 70 km head-to-head competition time trial over a virtual profiled 70 km time trial course. Note the differences in the x-axes of action crisis and blood cortisol concentrations due to different sampling times.

Abbreviations: % = time x group interaction effect; $ = simple (main) time effect for winners; § = simple (main) time effect for losers; * = simple (main) group effect

performance decrement. The findings point towards the primary and mediatory roles of core affect and mindset in perceived fatigability and the psychophysiological determinants of pacing and performance. The proposed three-dimensional framework has the potential to markedly improve our ability to explain something as complex and multi-faceted as centrally-regulated and goal-directed exercise behaviour.

References

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2 - 4 Venhorst et al. *Br J Sports Med* 2017. (In review).

Key words: Exercise behaviour, Psychophysiology, Performance, Perception, Endocrinology

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