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Original research

Deception has no acute or residual effect on cycling time trial performance but negatively effects perceptual responses

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ABSTRACT

Objectives: Feedback deception is used to explore the importance of expectations on pacing strategy and performance in self-paced exercise. The deception of feedback from a previous performance explores the importance of experience knowledge on exercise behaviour. This study aimed to explore the acute and residual effects of the deception of previous performance speed on perceptual responses and performance in cycling time trials.
Design: A parallel-group design.
Methods: Twenty cyclists were assigned to a control or deception group and performed 16.1 km time trials. Following a ride-alone baseline time trial (FBL), participants performed against a virtual avatar representing their FBL performance (PACER), then completed a subsequent ride-alone time trial (SUB). The avatar in the deception group, however, was unknowingly set 2% faster than their FBL.
Results: Both groups performed faster in PACER than FBL and SUB ($p < 0.05$), but SUB was not significantly different to FBL. Affect was more negative and Ratings of Perceived Exertion (RPE) were higher in PACER than FBL in the deception group ($p < 0.05$).
Conclusions: The presence of a visual pacer acutely facilitated time trial performance, but deceptive feedback had no additional effect on performance. The deception group, however, experienced more negative affect and higher RPE in PACER, whereas these responses were absent in the control group. The performance improvement was not sustained in SUB, suggesting no residual performance effects occurred.

1. Introduction

Feedback deception has been used as a non-invasive, practical method by which athletes' self-beliefs and expectations of their performance can be manipulated.[1,2] The intent is to explore how athletic performance may be optimised through the access of reserve capacities. A recent application of decision-making theories to self-paced exercise has drawn attention to the significance of expectations (relating to performance, environmental and/or perceptual information).[3,4] Therefore, by manipulating the performance feedback that athletes receive, the importance of these expectations can be examined.[5]

Previous deception studies have demonstrated that pacing strategy and performance are largely unaffected by the provision of incorrect performance feedback during self-paced cycling time trials (TT).[6,7] As feedback is most influential when it is attended to and evaluated in respect to salient self-goals[8], the type of feedback manipulated may have limited the effectiveness of the deceptive interventions. This is further supported by the suggestion that feedback must be mediated by previous experience to influence performance.[9] Pacing strategies are said to be based on a pacing 'schema' which is created through prior experience and recalled for future tasks.[10] During exercise, the current performance is evaluated against this stored schema to ensure that an optimal pacing strategy is adopted.[11] Feedback deception is employed in order to create a mismatch in this evaluation and trigger a decision to change behaviour, thus deviating from the learned schema.

One study demonstrated that cyclists improved performance when provided with visual feedback of their fastest previous 4 km

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TT.[12] Moreover, when this feedback was manipulated to represent 102% of the athletes' fastest baseline, performance was improved further; attributed to the accessing of a reserve capacity.[12] Alternatively, this is also supported by motivational theories stating that the presence of competition, in this case a faster self, can improve performance.[13]

Whilst some studies have shown that performance is influenced in a trial in which the deception is employed, i.e. an acute response, others have investigated the effects of deception on subsequent performance, i.e. a residual response.[9,14] If deceptive feedback is employed to manipulate the learned schema, then it is of interest to explore whether the alteration to this schema is retained in future exercise bouts. Micklewright et al.[9] found that an intensity deception elicited a significantly faster, but unsustainable, start in a subsequent 20 km TT. Using a distance feedback manipulation, another study found performance improvements in a subsequent TT which may have derived from enhanced self-efficacy and motivation following the deception exposure.[14] Research has yet to explore whether a deceptive intervention relating to a previous performance has a residual effect on self-paced exercise, despite an implication of a better understanding of the role of prior experience in the regulation of pace.

In addition to an influence on pacing strategy, previous experience might also be an important determinant of subsequent perceptual experiences during exercise. For example, the valence of emotions are the product of emotional responses experienced during previous performance accomplishments[15] and are pertinent to perceptions of self-efficacy[16] and future behaviour.[17] Furthermore, the experience of aversive situations is related to the development of perceptions of self-efficacy.[2] Despite many deception studies suggesting that these perceptual responses may be explicatory of altered pacing strategies and performance[18], few demonstrate evidence to substantiate these proposals. In particular, the measurement of during-task self-efficacy is a novel construct seldom explored in pacing or deception research.

The aim of this study was to explore the acute and residual effects of the deception of previous performance speed on perceptual responses and performance in 16.1 km self-paced cycling TT. It was hypothesised that deception would facilitate performance both acutely and residually, but in the presence of more negative perceptual responses.

2. Methods

Twenty trained male cyclists with 16.1 km TT race experience volunteered for the study. Participants provided prior written informed consent and the study was approved by the departmental research ethics committee. Match-paired, random allocation was used to assign participants to either a control (CON) or deception (DEC) group based on VO_{2peak} values and performance times achieved in TT1 (Table 1). Participants were classified as 'trained' according to VO_{2peak} and peak power output (PO) values.[19]

A 2 × 3 (group × trial) parallel-group design was adopted and participants visited the laboratory on five occasions, 2–7 days apart at the same time of day (±2 h), and within a 3 week period. After the initial maximal incremental test, both groups completed four 16.1 km cycling TTs (Fig. 1). A 16.1 km TT is the most common competitive road TT distance and therefore enhanced the external validity of the findings. Testing was conducted following the refrainment from strenuous exercise and alcohol consumption in the preceding 24 h and a 2 h fast and caffeine abstinence. Participants were instructed to maintain normal training and dietary practices throughout the testing period and provided training and nutritional diaries on their first visit. Diaries were replicated in the 24 h before each additional trial and between-trial conformity was checked. In the preceding two hours, fluid prescription comprised a minimum of 500 ml and water was consumed ad libitum during each trial. No significant differences were found in consumption between trials.

Table 1
Mean (SD) descriptive data for the CON and DEC groups.

	CON group (n = 10)	DEC group (n = 10)
Age (y)	35.4 (7.8)	36.0 (7.6)
Height (cm)	179.7 (5.1)	177.4 (6.8)
Body mass (kg)	81.5 (9)	78.5 (12.1)
Absolute PPO (W)	368 (34)	370 (42)
Relative PPO (W/kg)	4.6 (0.4)	4.8 (0.5)
Relative VO_{2peak} (mL kg min^{-1})	57.6 (6.7)	58.7 (6.6)
Absolute VO_{2peak} (L min^{-1})	4.7 (0.6)	4.6 (0.6)
Cycling experience (y)	>1	
Current training volume	»5 h or 100 km wk^{-1}	

CON, control; DEC, deception; PPO, peak power output; VO_{2peak}, maximal oxygen uptake.

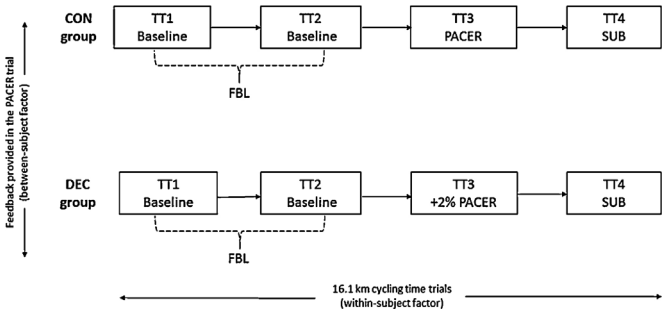

Fig. 1. Trial schematic of the research design for both CON and DEC groups. CON, control group; DEC, deception group; FBL, fastest baseline trial; PACER, pacer trial; SUB, subsequent trial; TT, time trial

On the first visit, height and body mass were recorded prior to a continuous incremental ramp test to maximal exertion on a cycle ergometer (Excalibur Sport, Lode, Groningen, The Netherlands) to determine VO_{2peak}. Following a 5 min warm-up at 100 W, initial workloads were determined using established guidelines[20] and 20 W increments were applied every minute until the required PO could no longer be maintained. Breath-by-breath pulmonary ventilation and gas exchange data were recorded throughout the test (Oxycon Pro, Jaeger, GmbH, Hoechburg, Germany) to record oxygen consumption, which was normalised to pre-exercise body mass data. The VO_{2peak} was defined as the highest VO_2 value recorded over a 20 s period. Heart rate (Polar Team System, Finland) was recorded continuously using a 5 s sampling rate and verbal encouragement was provided.

Both groups subsequently completed four self-paced 16.1 km TT on their own bicycles, using a calibrated electromagnetically-braked cycle ergometer (CompuTrainer Pro^{TM}, RacerMate, Seattle, USA); previously shown to be a reliable measure of PO.[21] A 0.6% coefficient of variation was found in our laboratory for between-trial variation in performance times (n = 31) and a 0.6% smallest worthwhile change in road TT performance has been previously reported.[22] The first two TTs (TT1, TT2) were used for familiarisation, but to prevent sub-maximal efforts being produced, participants were not informed of this. Ergometry software generated a flat, virtual course which was projected onto a 230 cm screen in front of the rider and which depicted the participants' speed profile as a synchronised graphical avatar. Time and PO were recorded at a rate of 34 Hz, but distance covered was the only variable displayed. Instructions were to complete each TT in the fastest time possible after a 10 min warm-up cycling at 70% of HR_{max} and the drafting option in the software was disabled.