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Changes in desire-goal motivational conflict predict pacing during an endurance cycling time trial

Izzy G. Wellings [a,*], Richard Ferguson [b], Ian M. Taylor [b]

[a] Loughborough University, University of Kent, United Kingdom
[b] Loughborough University, United Kingdom

A R T I C L E I N F O

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A B S T R A C T

This study examined whether the desire to reduce effort, performance goal value and the conflict between the two motives predicted pace during endurance performance. Fifty participants (25 males, 25 females, M_{age} = 22.10 years; SD = 3.03 years) completed an incrementally difficult sub-maximal cycling task to establish the starting intensity for a subsequent 8 km time trial. Following a 30-min rest, the goal was to complete the time trial as fast as possible, with participants being able to alter their work rate (i.e., watts) throughout. The desire to reduce effort, performance goal value, and time elapsed were measured at baseline and after each km. Results were analysed using multilevel modelling. Within-person changes in performance goal value predicted pace in the expected direction consistently during the time trial. Within-person changes in desire to reduce effort and the desire-goal conflict became increasingly important predictors of pace as the time trial progressed. Potential time-lagged effects of the desire to reduce effort on pace were also observed. The results provide greater understanding of the dynamic relationship between the desire-goal conflict and endurance performance.

1. Introduction

Endurance involves persisting against psychological and physiological discomfort to avoid failure, and its importance is appreciated in many domains of life and performance, such as sporting competition. Motivation is essential in understanding endurance behaviour and is one of the main forces controlling decisions regarding exercise (McCormick et al., 2015). Some theoretical perspectives view motivation as the underlying process of goal setting, rather than goal striving (e.g., Wolff & Englert, 2021). However, other perspectives view motivation as a broader term encompassing goal-setting and volitional processes, such as self-control (e.g., Dweck, 2017). Based on this latter view, a multidimensional approach to motivation has been presented, which encompasses both approach- and avoidance-oriented motivational processes (Taylor, 2021). The present study investigated whether this contemporary motivational model of endurance performance can be improved by the addition of a new component and whether relationships between variables change over time.

During endurance exercise, feelings of discomfort are common during physical exercise, (e.g., Cook et al., 1997; Gunn & Taylor, 2021). These responses typically result in an aversive motivational state characterised by a drive to act on the uncomfortable sensations by reducing workload, which is referred to as a desire to reduce effort in endurance contexts (Taylor, 2021). These responses result in an aversive motivational state characterised by a drive to avoid uncomfortable sensations, which is referred to as a desire to reduce effort in endurance contexts (Taylor, 2021).[1] This hedonic, proximal motivation contrasts against the reflective, approach-oriented performance goal. While the content of this goal can vary (e.g., winning a race or exerting maximum effort), it is the motivational value (i.e., magnitude) which competes with the desire to reduce effort (Taylor, 2021). In line with the self-control literature, this desire-goal conflict represents a dilemma that arises because two contradictory motivational processes co-activate (Fishbach & Woolley, 2018; Kotabe & Hofmann, 2015). The outcome of this conflict subsequently leads to either increasing or maintaining effort in pursuit of successful performance or reducing effort to appease the discomfort (Taylor et al., 2020).

The desire to reduce effort and performance goal have different trajectories over the course of an endurance bout with shifts and accelerations surrounding physiological thresholds (Taylor et al., 2022). Moreover, both motivational factors predict performance-related outcomes in various exercise scenarios. More successful performances are

* Corresponding author. School of Sport, Exercise & Health Sciences, Loughborough University, Leicestershire, LE11 3TU, United Kingdom.
E-mail address: iw13@kent.ac.uk (I.G. Wellings).

[1] In this case, reducing effort refers primarily to the current work rate, rather than subjective experience of perceived effort or exertion.

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associated with a lower initial desire to reduce effort alongside a slower decreasing performance goal during a high intensity bout of cycling (Taylor et al., 2020). Furthermore, the desire to reduce effort increases more slowly and the performance goal value is more robust for experienced athletes compared to untrained individuals during high intensity cycling (Wellings et al., 2025). Nonetheless, the conflict between the two motives may not only be characterised by their individual strengths, but also the discrepancy between the two opposing constructs (Taylor et al., 2022). For example, when the performance goal easily outweighs the desire to reduce effort, effort-based decisions are relatively straightforward. However, as the discrepancy decreases or potentially reverses in direction, reducing effort during an endurance bout becomes an increasing possibility. These effects will likely occur irrespective of the absolute values of the desire and goal. Despite the plausibility of this idea, it has never been investigated. In other words, it is unknown whether the conflict between the value of the desire to reduce effort and the performance goal explain performance, over and above the magnitude of the individual motivational constructs.

Understanding whether the conflict (i.e., discrepancy) predicts performance will enable us to better explain the decision-making process and how competing motivational forces interact during endurance exercise. There is evidence that physiological responses influence both hedonic and reflective motivation (Ekkekakis & Brand, 2021; Zajonc, 1980). However, this study offers an extra explanation beyond approach and avoidance constructs being viewed as independent. Furthermore, the investigation of the conflict can help refine those theories addressing goal pursuit and behavioural persistence (Taylor, 2021), possibly demonstrating that competing influences or the conflict fluctuates in magnitude and the separate concepts dominate at differing times, influencing behavioural outcomes during endurance efforts. This study can help to bridge the gap between broader motivational models of endurance behaviour (e.g., Pageaux, 2014) and psychological theories of self-control (Ryan & Deci, 2000), deepening our knowledge of decisions during endurance exercise.

In addition to this gap in knowledge, no previous study has looked at whether the within-person relationships between the desire-goal conflict and performance change over time (i.e., pace). During early phases of exercise, the desire to reduce effort is typically low and may, therefore, have limited influence on pace. As the intensity and duration of exercise progresses, however, the influence of hedonic phenomena may increase. In contrast, performance goal is typically higher at the start of an endurance bout with gradual decreases during moderate intensity and occasional increases during high intensity exercise (Wellings et al., 2025). Nonetheless, it is not known if these changes in performance goal are mirrored in pacing behaviour. Taken together, it is thought that the influence of the desire to reduce effort, performance goal value, and conflict between the two on pacing may change over the course of an endurance effort.

In summary, the present study aimed to examine the hypothesis that within-person changes in the desire to reduce effort, performance goal value and the conflict (i.e., discrepancy between desire to reduce effort and performance goal value each uniquely predicted pace (i.e., time per kilometre (km)) during an eight km time trial. Furthermore, this study also tested if the relationship between the psychological variables (desire to reduce effort, performance goal value and the conflict) and pacing behaviour changed over time. This latter analysis was exploratory and there were limited grounds to form a directional hypothesis.

2. Methods

2.1. Participants

All experimental procedures were approved by the ethics approvals committee at a large university in the UK and conformed with the Declaration of Helsinki. Inclusion criteria stated that participants were 18–40 years old, physically active (defined as $\geq$ 150 min of at least moderate-intensity activity per week for three months), and free of pre-existing medical conditions or family history that made high intensity exercise potentially dangerous. Fifty participants were recruited through social media and word of mouth (25 males and 25 females, M_{age} = 22.10 years; SD = 3.03 years). No a-prior sample size estimation was conducted, instead the sample size was chosen based on a minimum of 50 level-2 units (i.e., participants) required for minimal bias in multilevel modelling parameters when combined with three or more level 1 units (the present study had nine measurement points at level 1).

Participants were fully informed of study details including the risks and discomforts associated with the experimental trial. It was clarified that participation was voluntary, data would be stored anonymously, and they could exercise their right to withdraw at any point during the study. Participants provided written informed consent and completed questionnaires to establish they met the inclusion criteria. Following consent, participants performed an incrementally difficult, sub-maximal test on a cycle ergometer (Lode Excalibur Sport, Lode B.V. Gronigen, The Netherlands). Ergometer saddle and handlebar dimensions were set up to suit individual specifications. No warm-up was included as the early stages of the trial were considered sufficiently easy to constitute a warm-up. The test began at 50 W (W) and power increased by 35 W every 3 min with participants' cadence maintained above 70 rpm. The test continued until the participant reached 85 % of their estimated maximum safe heart rate to exercise at for their age (i.e., 220 minus age); an intensity high enough to elicit a constant build-up of blood lactate (Dumke et al., 2006). Capillary blood samples were taken from the finger during the last 30 s of each 3-min stage and heart rate was continually measured (Polar Electro Oy, Kempele, Finland). Blood lactate measurements were analysed within 10 min of the test using ExPhysLab (2025) software and were used to establish participants' second lactate threshold, characterised as a value of four mmol^{-1} (Faude et al., 2009). The corresponding power at this lactate threshold was used as the starting watts for the experimental trial.

Participants then rested for 30-min, which has been shown to be a suitable period for healthy participants and clinical patients to recover from similar fitness tests (e.g., Cavalheri et al., 2016; Coll et al., 2020). Participants then undertook a 2-min warmup at 25 W followed by an eight km time trial on the cycle ergometer. Although the relative starting intensity was fixed, the entire bike test was self-paced, and participants were able to ask for the watts to be increased or decreased by five or more watts at any time during the trial. The goal to complete the time trial as quick as possible was written on the wall in front of participants and served as the only motivation or reminder of the goal throughout the time trial. At baseline and after every km during the trial, participants were presented with the measures to establish desire to reduce effort and performance goal value. As outlined in the pre-registration of this study (see below for details), blood lactate and affect were measured throughout the study, but they did not relate to the study hypothesis (however, see footnote 2 for extra analysis requested by anonymous reviewers).

2.2. Measures

Desire to reduce effort, performance goal value, and discrepancy score. The desire to reduce effort was measured by verbal responses to the instruction "Please rate to what extent you want to reduce your effort" on a scale, ranging from 0 (not wanting to reduce effort at all) to 20 (definitely want to reduce effort immediately). The value of the performance goal was measured by responding to the instruction "Please rate how important is it to achieve your goal" on a scale, ranging from 0 (not important at all) to 20 (extremely important). These scales have previously demonstrated predictive and nomological validity (Taylor et al., 2022; Wellings et al., 2025). The discrepancy score was calculated by subtracting the value for performance goal from the value for desire to reduce effort. Scores for these variables were taken each km. This calculation means that positive scores reflect a higher relative desire to reduce effort, and negative scores reflect a higher relative performance goal value.

Pace. Pace was measured as the time in seconds to complete each km of the trial.

2.3. Pre-registered data analysis

A pre-registered data analysis plan can be found at https://osf.io/3jr9u/overview?view_only=2856aeec863b4b008bdd8ebc38069a1c. Multilevel analysis using MLwiN (version 3.05; Rasbash et al., 2015, p. 296) was used to test the study hypotheses. Two models contained pace as the dependent variable. Model 1 consisted of the desire to reduce effort and performance goal as independent variables. Model 2 included the conflict (i.e., discrepancy score) between desire to reduce effort and performance goal as a third independent variable, to investigate if this variable predicted pace over and above desire to reduce effort and performance goal value. Independent variables were group mean centred around each participant's unique mean; therefore, they examined whether any deviations in the independent variables from participants' mean scores predicted pace in the corresponding km.

2.4. Unregistered data analysis

Following the planned data analysis, three more multilevel models were created to examine whether the hypothesized relationships differed over time. Model 3 consisted of a linear time predictor variable (coded as 0, 1, 2, 3 etc.), performance goal value (group mean centred, as previously), and a higher order interaction between these two variables. Subsequent models were similar, but replaced performance goal value with desire to reduce effort (Model 4) and desire-goal conflict (Model 5). Any significant interactions were then investigated using guidelines for simple slopes analysis applied to multilevel modelling (Preacher et al., 2006).

3. Results

3.1. Descriptive analysis

During the preliminary fitness test, average power output when participants reached 85 % age max heart rate was 184.40 W (Standard deviation = 29.46 W) with a greatest power output of 260 W. Average heart rate when the test was terminated was 163.42 bpm (Standard deviation = 14.34 bpm). Average power at lactate thresholds, characterised by an initial increase of 1 mmol-1 and a blood lactate concentration of 4 mmol-1, was 113.86 W (Standard deviation = 33.99 W) and 166.18 W (Standard deviation = 34.93 W), respectively.

Descriptive statistics for the study variables at each km for the time trial can be found in Table 1. Participants completed the time trial in an average of 11 min and 2 s (*SD* = 2 min, 33 s). Intercept only models revealed that 66 % of the variance in the desire to reduce effort was at the within-person level and 34 % was at the between-person level. Thirty-one percent of the variance in performance goal value was at the within-person level and 69 % was at the between-person level. Fifty-seven percent of the variance in the desire-goal conflict was at the within-person level and 43 % was at the between-person level. Finally, 10 % of the variance in pace was at the within-person level, whereas 90 % was at the between-person level.

3.2. Pre-registered analysis

Results for Model 1 can be seen in Table 2 and demonstrated that increases in performance goal value were associated with faster pace, as expected (the negative coefficient was observed because lower scores reflected quicker times, therefore, faster pace). However, in contrast to theoretical expectations, increases in desire to reduce effort also predicted quicker pace. This relationship was checked for the influence of statistical suppression by constructing a multilevel model with just desire to reduce effort predicting pace. The relationship was non-significant ($b = -.12$; $p = .18$), but it remained in the unexpected direction. We further examined whether a time-lag occurred in which the desire to reduce effort negatively impacted pace in the subsequent km. This relationship between desire to reduce effort at time point −1 and performance was statistically significant and in the expected direction ($b = .31$, $p < .001$).

Model 2 revealed the desire-goal conflict (i.e., discrepancy score) did not predict pace over and above the desire to reduce effort and performance goal value. Furthermore, the inclusion of the conflict did not significantly improve model fit (χ^2 difference = 1.04; $df = 1$; $p = .31$).[2]

3.3. Unregistered analysis

Three more models investigating the effect of the psychological variables over time on pace were explored (see Table 2). Model 3 revealed the performance goal value was associated with quicker pace and this relationship did not change over time. Further, the inclusion of the interaction term did not improve model fit (χ^2 difference = .90; $df = 2$; $p = .64$). Model 4 demonstrated the association between desire to reduce effort and pace changed over time and inclusion of the interaction term significantly improved the model fit (χ^2 difference = 22.83; $df = 2$; $p < .001$). Simple slopes analysis revealed there was no relationship between desire to reduce effort and pace at the beginning of the trial ($b = .16$, $p = .40$). However, as the trial progressed the relationship between desire to reduce effort and pace strengthened with a significant relationship from three km onwards ($b = .54$, $p = .02$) and strongest relationship at the end of the trial ($b = 1.50$, $p < .001$).

Model 5 demonstrated the influence of the desire-goal conflict on pace also changed over time and inclusion of the interaction term significantly improved the model fit (χ^2 difference = 22.52; $df = 2$; $p < .001$). Similar to the desire to reduce effort, the relationship between the desire-goal conflict and pace strengthened as the trial progressed. The relationship was not significant at the beginning of the trial ($b = .03$, $p = .87$) but became significant from four km ($b = .49$, $p = .03$) and was strongest during the last km ($b = 1.12$, $p < .001$).

4. Discussion

The desire-goal conflict is a valid framework for studying human endurance performance (Taylor et al., 2020). The present study built on

[2] As we measured affect in the study, an anonymous reviewer suggested we include affect in our models. Our conclusions regarding the relationship between desire to reduce effort, performance goal value, and pace did not substantively change when affect was included in the models (desire to reduce effort; $b = -.09$, $p = .56$, performance goal; $b = -.51$, $p = .01$). Furthermore, affect did not significantly predict pace ($b = .31$, $p = .27$) which could indicate that either a) it has no influence or b) its influence is mediated by desire and/or goal. The latter possibility is in line with theoretical expectations. A second reviewer suggested we also test these relationships after controlling for peak power. The conclusions do not substantively change (desire to reduce effort; $b = -2.11$, $p = .29$, performance goal; $b = -16.43$, $p < .001$), and peak power was not significantly associated with pace ($b = -.16$, $p = .26$), which may indicate that the psychological predictors are more proximal influences than peak power.

Based on further reviewer comments, we constructed a model with participants' average levels of desire to reduce effort and goal value as predictors of total time trial time. The results show that goal ($b = -16.72$, $p < .001$) predicts performance, but desire does not ($b = -2.84$, $p = .14$). When discrepancy is added into the model, no predictor variable is significant (desire to reduce effort; $b = -81.67$, $p = .35$; performance goal; $b = 61.88$, $p = .48$; discrepancy; $b = 78.57$, $p = .37$). These analyses suggest that the performance goal is the most reliable indicator of overall performance, which is consistent with the conclusions on pacing that we make based on the main analysis.

Table 1
Descriptive statistics (mean and standard deviation) for all study variables[a].

	Desire	Goal	Conflict	Affect	Blood lactate concentration (mmol^{-1})	Performance (s)	Average power (W)
Baseline	.04 (.28)	17.80 (2.93)	−17.76 (2.95)	3.92 (1.58)	1.74 (.59)		
1 km	3.00 (3.14)	17.56 (2.96)	−14.56 (4.92)	3.20 (1.43)	.071 (.24)	87.60 (17.20)	177.47 (34.07)
2 km	4.94 (4.13)	17.40 (3.14)	−12.46 (5.77)	2.38 (1.63)	4.36 (1.11)	81.32 (18.16)	193.33 (43.45)
3 km	6.64 (4.50)	17.24 (3.15)	−10.60 (6.23)	1.70 (1.81)		80.56 (17.29)	194.77 (42.69)
4 km	7.84 (4.36)	16.78 (3.25)	−9.04 (6.04)	.92 (1.87)	7.35 (1.90)	81.36 (18.58)	193.60 (43.69)
5 km	8.86 (4.47)	16.68 (3.11)	−7.82 (6.29)	.34 (1.91)		82.62 (20.26)	191.58 (45.27)
6 km	10.18 (4.83)	16.10 (3.72)	−5.96 (6.90)	−.60 (2.01)	8.89 (2.20)	83.03 (20.81)	191.14 (46.16)
7 km	10.38 (6.06)	16.58 (4.25)	−6.20 (8.41)	−1.00 (2.13)		83.88 (22.51)	190.37 (47.84)
8 km	10.34 (6.88)	17.30 (4.04)	−6.86 (8.76)	−1.36 (2.59)	10.04 (2.34)	82.23 (23.46)	194.52 52.23)

Note: km = kilometre; s = seconds.
[a] Affect, blood lactate, and power were not relevant to study hypotheses but measured in the study.

Table 2
Multilevel models describing the relationships of performance goal, desire to reduce effort and conflict with performance and changes over time.

Outcome	Model 1	Model 2	Model 3	Model 4	Model 5
Fixed Effects (SE in parentheses)					
Intercept	**82.96 (2.68)**	**82.96 (2.68)**	**83.69 (2.76)**	**82.05 (2.81)**	**82.50 (2.81)**
Performance goal	**−.53 (.19)**	.77 (1.29)	.16 (.58)		
Desire	**−.21 (.09)**	−1.53 (1.30)		**−1.06 (.24)**	
Conflict		1.32 (1.30)			**−.76 (.20)**
Linear Time			−.02 (.14)	−.03 (.18)	−.13 (.17)
Time x goal			−.10 (.10)		
Time x desire				**.19 (.04)**	
Time x conflict					**.15 (.03)**
Random Effects					
Level 1	**37.94 (2.88)**	**37.83 (2.88)**	**38.04 (2.88)**	**36.29 (2.74)**	**36.47 (2.76)**
Level 2	**354.49 (71.77)**	**354.51 (71.77)**	**356.25 (72.20)**	**358.64 (72.63)**	**360.97 (73.1)**

Note. Bold figures indicate statistical significance ($p < .05$). Exact values can be calculated from the Z scores (b/SE).

existing work by investigating whether the conflict, or discrepancy, between the magnitude of the desire to reduce effort and performance goal contributes to explaining pace during an eight km laboratory-based time trial, over and above the individual components. In addition, this study examined if the relationships among desire to reduce effort, performance goal value, conflict score and pacing behaviour changed over the course of the time trial. In general, performance goal value predicted pace consistently throughout the whole trial. The influence of the desire to reduce effort and the conflict on pacing behaviour increased as the trial progressed. Therefore, some relationships between motivation and performance are dynamic and time should be considered in future explanatory frameworks.

In the present study, the greater the value of the performance goal the better participants' concurrent cycling pace. Previous research has shown worse overall performance is associated with a more rapidly decreasing performance goal (Taylor et al., 2020). This study adds to this evidence by demonstrating that within-person changes in performance goal value predict pace throughout the entirety of a time trial. In addition, the performance goal value is a stable psychological predictor of performance over time, and the only motivational predictor of pace in the early stages of the endurance effort. This amplifies the importance of maintaining a high value performance goal for as long as possible and ensuring a salient goal is set prior to starting. This could be achieved by emphasizing goals that are congruent with one's sense of self (i.e., autonomous or intrinsic goals; Bradshaw, 2023), which would increase the value of the performance goal (Taylor et al., 2025).

Desire to reduce effort was also associated with better concurrent pace (i.e., during the same km), this had not been seen in previous studies investing the desire-goal framework and other types of performance, however, further exploration of this relationship hinted at a time lagged effect. Specifically, a within-person increase in desire to reduce effort was associated with faster simultaneous pace, but slower pace in the subsequent kilometre. This finding implies that the relationship between desire to reduce effort and performance, at least in terms of pacing behaviour, could be bidirectional. An increase in pace (i.e., work rate) may result in a relatively immediate increase in desire to reduce effort rather than vice versa (i.e., an increased desire to reduce effort causing individuals to slow down). In turn, this increase in desire to reduce effort seems to lead individuals to reduce pace in the subsequent km. This process might be pronounced when the increase in work rate breaches physiological thresholds and individuals can no longer sustain this work rate (e.g., lactate threshold; Taylor et al., 2022; Wellings et al., 2025). This suggests that appropriate pacing is key to avoid unnecessary motivational consequences and the bidirectional relationship between the desire to reduce effort and pace needs to be acknowledged in models explaining endurance performance.

To add complexity, the concurrent relationship between desire to reduce effort and pace changed over the course of the trial with the relationship becoming statistically significant from two km onwards. Previous evidence has shown a consistent relationship between individual differences in desire to reduce effort and less successful endurance performance (Taylor et al., 2020). The current study differs by demonstrating that within-person fluctuations in desire to reduce effort do not have significant influence on pace in the early parts of an endurance bout. At low levels, increases in the desire to reduce effort may not be sufficient to activate behavioural responses, compared to changes at higher levels. Alternatively, the underpinnings of the desire to reduce effort may vary across an endurance trial which could impact its relationship with performance. For example, in the early stages of endurance exercise, the desire to reduce effort may be underpinned by psychological factors, such as the rising subjective cost of effort (cf. Kurzban et al., 2013), which may be relatively easier to disregard or overcome to prevent reductions in pace or performance. In contrast, when metabolic discomfort such as increasing blood lactate concentration becomes the main basis for a desire to reduce effort, it may have substantial effects on time trial pacing.

Existing studies examining the desire-goal conflict framework have focused on the magnitude of the desire to reduce effort and performance goal value, but never the conflict (or discrepancy) between the two. Results from the present study did not provide conclusive evidence that this additional factor warrants attention when explaining endurance performance. Specifically, the conflict between desire to reduce effort and performance goal did not predict pace over and above the two separate psychological constructs in the first model. However, when examining the relationship between the desire-goal conflict separately from the individual components, the relationship became increasingly meaningful over the course of the trial. It is possible the conflict influences pace only during difficult decision-making periods (Berkman et al., 2017) (i.e., whether to reduce effort or not), which are typically later in the time trial. Nonetheless, the performance goal value is relatively stable compared to the desire to reduce effort (Wellings et al., 2025). Therefore, any changes in the discrepancy between the two variables are more likely to be underpinned by changes in desire to reduce effort, rather than performance goal value. The discrepancy score in Model 4, therefore, may simply reflect to a large degree changes in desire to reduce effort, which also explains why the relationship between the conflict and pace (Model 5) mirrors that of the desire to reduce effort and pace (Model 4). When desire to reduce effort is accounted for (Model 2), the conflict has no influence on pace. Overall, it's not possible to confidently claim that the conflict between the two motivational constructs is important for endurance performance.

4.1. Future directions & limitations

This study examined the relationship between pace, desire to reduce effort, performance goal value and the conflict between the two motivational variables. However, some limitations and future research implications warrant discussion. First, although our primary dependent variable was pacing behaviour, the findings should not be contextualised within the classic pacing behaviour literature, which typically examines experienced athletes (e.g., Casado et al., 2024). The participants in this study were not trained athletes, therefore, likely lacked the prior experience necessary for strategic pacing aimed at the optimal distribution of effort over the trail. Instead, the pacing was likely based on crisis management because the starting intensity was too high for participants to sustain.

Second, the goal presented to participants in the current study was 'To complete the eight km time trial as quick as possible'. However, different goals contents have different levels of resilience, therefore, further research should manipulate the goal content and examine the robustness of the performance goal value. For example, ego-orientated goals tend to be more fragile than other goal types (Williamson et al., 2022), yet competitive goals may be less fragile than personal goals (Ives et al., 2020). Third, recruitment for this study focused on an active, healthy population, however, different populations could exhibit different results. For example, the conflict may arise more rapidly in a less active population compared to elite, as their performance goal devalues more rapidly coupled with a rapidly increasing desire to reduce effort (Wellings et al., 2025). Future research could also investigate how to delay the desire-goal conflict within different populations. Less active populations could use strategies such as practising resilient goal setting (Sheehan et al., 2018), whereas elite athletes may benefit from attentional focus training concerning the sensations they are experiencing (Birrer & Morgan, 2010).

In the present study, the desire to reduce effort decreased slightly from 7 km to 8 km along with a slight increase in the performance goal value. This suggests the presence of the 'end spurt' phenomenon (Morris et al., 2020), where motivation changes trajectory towards the end of an endurance bout. Further research could investigate psychophysiological factors that impact on this phenomenon within the context of the desire-goal conflict. For example, the performance goal may gain importance or desire to reduce effort becomes less salient as individuals reach the end of an endurance bout.

Single-item measures of the desire to reduce effort and performance goal value were used to avoid over burdening the participants and researchers. While these items have demonstrated some aspects of validity in previous work, more assessment is necessary. Future research should validate the single items against established multi-item scales where administration is feasible, report test–retest and/or within-person reliability, and examine the relationships with more established single-item scales, such as a rating of perceived exertion (Borg, 1998). Finally, the construct validity of the desire to reduce effort could be explored to discriminate from the desire to reduce discomfort. This will help decipher where this framework fits within the wider research area of motivation during endurance exercise.

5. Conclusion

The present study experimentally demonstrated that within-person changes in the performance goal value and desire to reduce effort are important considerations for endurance performance in active populations. It was not possible to establish whether the conflict (i.e., discrepancy) between these two psychological variables is influential. Within-person changes in performance goal value consistently predicted performance throughout the time trial, implying that it is imperative to set resilient goals during an endurance bout. Furthermore, the results demonstrated the dynamicity of the relationship between desire to reduce effort and pace. Desire to reduce effort did not predict pace in the early phases of the endurance trial but became increasingly influential. In addition, a time-lagged effect was observed, suggesting that the relationship between desire to reduce effort and pace is bidirectional. Frameworks that attempt to explain endurance performance should integrate these temporal nuances.

CRediT authorship contribution statement

Izzy G. Wellings: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Richard Ferguson:** Visualization, Supervision, Resources, Methodology, Conceptualization. **Ian M. Taylor:** Writing – review & editing, Visualization, Supervision, Methodology, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

https://osf.io/3jr9u/overview?view_only=2856aeec863b4b008bdd8ebc38069a1c. Multilevel model outputs are available to replicate.

References

Berkman, E. T., Hutcherson, C. A., Livingston, J. L., Kahn, L. E., & Inzlicht, M. (2017). Self-control as value-based choice. *Current Directions in Psychological Science, 26*, 422–428. https://doi.org/10.1177/0963721417704394

Birrer, D., & Morgan, G. (2010). Psychological skills training as a way to enhance an athlete's performance in high-intensity sports. *Scandinavian Journal of Medicine & Science in Sports, 20*, 78–87.

Borg, G. (1998). *Borg's perceived exertion and pain scales*. Human kinetics.

Bradshaw, E. L. (2023). Causes, costs, and caveats: Reflections and future directions for goal contents theory. In R. M. Ryan (Ed.), *The Oxford handbook of self-determination theory* (pp. 139–159). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780197600047.013.7.

Casado, A., Ranieri, L. E., Hanley, B., Foster, C., & González-Mohíno, F. (2024). Differences in pacing behaviour between global championship medal performances and world records in men's and women's middle- and long-distance running track events. *Journal of Sports Sciences, 42*(4), 358–364. https://doi.org/10.1080/02640414.2024.2330819

Cavalheri, V., Jenkins, S., Cecins, N., Gain, K., & Hill, K. (2016). Comparison of the six-minute walk test with a cycle-based cardiopulmonary exercise test in people following curative intent treatment for non-small cell lung cancer. *Chronic Respiratory Disease, 13*(2), 118–127.

Coll, F., Hill, K., Burrows, S., Watson, C., & Edgar, D. (2020). Modified Chester step test in a healthy adult population: Measurement properties and development of a regression equation to estimate test duration. *Physical Therapy, 100*(8), 1411–1418.

Cook, D. B., O'Connor, P. J., Eubanks, S. A., Smith, J. C., & Lee, M. (1997). Naturally occurring muscle pain during exercise: Assessment and experimental evidence. *Medicine & Science in Sports & Exercise, 29*(8), 999–1012. https://doi.org/10.1097/00005768-199708000-00004

Dumke, C. L., Brock, D. W., Helms, B. H., & Haff, G. G. (2006). Heart rate at lactate threshold and cycling time trials. *The Journal of Strength & Conditioning Research, 20*(3), 601–607.

Dweck, C. S. (2017). From needs to goals and representations: Foundations for a unified theory of motivation, personality, and development. *Psychological Review, 124*(6), 689.

Ekkekakis, P., & Brand, R. (2021). Exercise motivation from a post-cognitivist perspective: Affective-reflective theory. In *Motivation and self-regulation in sport and exercise* (pp. 20–40). Routledge.

Faude, O., Kindermann, W., & Meyer, T. (2009). Lactate threshold concepts: How valid are they? *Sports Medicine, 39*, 469–490.

Fishbach, A., & Woolley, K. (2018). Combatting temptation to promote health and well-being. In D. de Ridder, M. Adriaanse, & K. Fujita (Eds.), *The routledge international handbook of self-control in health and well-being* (pp. 167–179). Routledge/Taylor & Francis Group. https://doi.org/10.4324/9781315648576-14.

Gunn, C. P., & Taylor, I. M. (2021). Using the think aloud protocol to measure desire-goal conflict and conflict resolution in a postural persistence task. *Measurement in Physical Education and Exercise Science, 25*(2), 87–94.

Ives, J. C., Neese, K., Downs, N., Root, H., & Finnerty, T. (2020). The effects of competitive orientation on performance in competition. *The Sport Journal, 41*(2), 5.

Kotabe, H. P., & Hofmann, W. (2015). On integrating the components of self-control. *Perspectives on Psychological Science, 10*(5), 618–638. https://doi.org/10.1177/1745691615593382

Kurzban, R., Duckworth, A., Kable, J. W., & Myers, J. (2013). An opportunity cost model of subjective effort and task performance. *The Behavioral and brain sciences, 36*(6), 661–679. https://doi.org/10.1017/S0140525X12003196

McCormick, A., Meijen, C., & Marcora, S. (2015). Psychological determinants of whole-body endurance performance. *Sports Medicine, 45*, 997–1015.

Morris, M. B., Haubert, A. R., & Gunzelmann, G. (2020). Beyond the vigilance end-spurt with event-related potentials. In *Proceedings of the human factors and ergonomics society annual meeting* (Vol. 64, pp. 1258–1262). Sage CA: Los Angeles, CA: SAGE Publications, 1.

Pageaux, B. (2014). The psychobiological model of endurance performance: An effort-based decision-making theory to explain self-paced endurance performance. *Sports Medicine, 44*(9), 1319–1320.

Preacher, K. J., Curran, P. J., & Bauer, D. J. (2006). Computational tools for probing interactions in multiple linear regression, multilevel modeling, and latent curve analysis. *Journal of Educational and Behavioral Statistics, 31*(4), 437–448.

Rasbash, J., Browne, W. J., Healy, M., Cameron, B., & Charlton, C. (2015). *A user's guide to MLwiN*. Bristol, UK: University of Bristol. https://hdl.handle.net/1983/6f7063c0-1e61-433c-9ad4-825893e05f4f.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55*(1), 68.

Sheehan, R. B., Herring, M. P., & Campbell, M. J. (2018). Associations between motivation and mental health in sport: A test of the hierarchical model of intrinsic and extrinsic motivation. *Frontiers in Psychology, 9*, 707. https://doi.org/10.3389/fpsyg.2018.00707

Taylor, I. M. (2021). A motivational model of endurance and persistence. In C. Englert, & I. M. Taylor (Eds.), *Motivation & self-regulation in sport and exercise* (pp. 87–101). Routledge.

Taylor, I. M., Drewes, L., Fort, D., Horne, G., Quercia-Smale, S., & Wellings, I. G. (2025). Athletic identity and autonomous motivation as predictors of endurance performance during high intensity exercise. *Psychology of Sport and Exercise, 80*, Article 102872. https://doi.org/10.1016/j.psychsport.2025.102872. Advance online publication.

Taylor, I. M., Smith, K., & Hunte, R. (2020). Motivational processes during physical endurance tasks. *Scandinavian Journal of Medicine & Science in Sports, 30*(9), 1769–1776.

Taylor, I. M., Whiteley, S., & Ferguson, R. A. (2022). Disturbance of desire-goal motivational dynamics during different exercise intensity domains. *Scandinavian Journal of Medicine & Science in Sports, 32*(4), 798–806.

Wellings, I. G., Ferguson, R. A., & Taylor, I. M. (2025). Affect mediates the relationship between physiological and motivational responses to exercise. *Journal of Sports Sciences*, 1–9.

Wellings, I. G., Ferguson, R., & Taylor, I. M. (2025). Differences in motivational dynamics between experienced cyclists and untrained participants during an incremental endurance exercise task. *Psychology of Sport and Exercise, 76*, Article 102753.

Williamson, O., Swann, C., Bennett, K. J. M., Bird, M. D., Goddard, S. G., Schweickle, M. J., & Jackman, P. C. (2022). The performance and psychological effects of goal setting in sport: A systematic review and meta-analysis. *International Review of Sport and Exercise Psychology, 17*(2), 1050–1078. https://doi.org/10.1080/1750984X.2022.2116723

Wolff, W., & Englert, C. (2021). On the past, present and future of volition research in sports. *Zeitschrift für Sportpsychologie, 28*(3), 81–83.

Zajonc, R. B. (1980). Feeling and thinking: Preferences need no inferences. *American Psychologist, 35*(2), 151–175. https://psycnet.apa.org/doi/10.1037/0003-066X.35.2.151.