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Adaptive self-regulation in cycle time trials: goal pursuit, goal disengagement and the affective experience

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Abstract

Self-regulation research analyses behaviour and emotion through goal progress (Carver and Scheier 2013). Goal disengagement is advocated as an adaptive self-regulatory strategy for unattainable goals to reduce distress (Wrosch et al. 2003a; 2003b). In an attempt to further understand ongoing goal pursuit and emotions on endurance athletes, this paper applies adaptive self-regulation theory to interpret and explain the experiences of three cyclists in case studies which display variations in success and failure. Following criterion sampling methods we analysed positive and negative affect, goal expectancy and power output from three male participants (triathletes or cyclists; age range 26-50 yrs) who either successfully achieved their goal (Participant 1), were unsuccessful yet recalculated their goal (Participant 2) or failed to achieve their goal (Participant 3) in a 20 km laboratory cycle time trial. Post trial qualitative data provided explanations regarding pacing, perceptions of achievement and feeling states (self-chosen adjectives). Positive affect tracked goal expectancy with increases in positive affect when power output exceeded previous trial averages and goal expectations were high evidencing successful goal striving (Participant 1). Reductions in positive affect occurred where goal progress was below expectations. This reduction was dramatic in the unsuccessful trial (Participant 3). Low levels of positive affect and high levels of negative affect were reported from 12 – 20 km together with disappointment, unexpected feelings of a loss of control and fatigue, suggesting unsuccessful goal striving. Supporting goal disengagement theory, a relinquishment of goal commitment was evident for participant 2 who recalculated his goal. Despite being unsuccessful in achieving his original goal participant 2 reported positive feeling states and perceptions of control post trial indicating adaptive self-regulation strategies were effective in his specific situation. These findings emphasise the need to examine practical adaptive self-regulation strategies in sport and relationships between affect, decision making and goal striving.

Keywords: self-regulation, goal pursuit, goal disengagement, affect, cycling

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Introduction

Attaining goals and reaching success in sport often requires athletes to balance their efforts with their expectations of success (Wrosch et al. 2003a; 2003b). Self-regulation (Carver and Scheier, 1998; Carver and Scheier, 2013) and adaptive self-regulation (Wrosch et al. 2003a; 2003b) offer suitable frameworks to explore and derive some explanation for the success or failure of the cycle time trialist from a psychological perspective. Concentrating on both action and emotion, the conflicting experiences of goal pursuit versus goal disengagement, positive versus negative affect and confidence versus doubt, contribute to the analysis of complex human behaviour in the context of both short term goals or longer term goals from a life span perspective (Carver and Scheier, 1998; Wrosch et al. 2003a).

Goal pursuit and goal disengagement is underpinned by decision-making and a recent review by Renfree et al. (2014) proposed a richer understanding of pacing behaviour within endurance sports would result through greater consideration of the relationship between emotions and decision making. There is a lack of empirical evidence integrating both of these research fields together within sport currently (Laborde et al. 2013). During any competitive sporting activity, important decisions are made continuously by individuals regarding what goals to pursue and when and how to strive for these goals. In self-paced competitive endurance sports, positive and negative affect, afferent physiological information, motivation and goal setting play a role in this decision-making process (Renfree et al. 2014). Assessment of both the potential benefits (likelihood of success, positive feelings) and risks (failure, negative feelings, physiological catastrophe) contribute to these choices (Renfree et al. 2014) all the while acting as part of the self-regulation system; assessing one's progress towards or away from one's desired goal and altering

subsequent behaviour to optimise goal attainment (Carver and Scheier 1998).

Goal pursuit and subsequent goal attainment elicits positive affect (Carver and Scheier, 1990; Gaudreau at al. 2002; Rhoden et al. 2014). However when goal pursuit is deemed no longer favourable, perhaps where the risk is perceived as high with little or no benefit (Renfree et al. 2014), an individual may give up the goal (goal disengagement) and alternative goal directed behaviour ensues (Wrosch et al. 2003a). When goal disengagement occurs, self-regulation theory suggests initial subsequent thoughts can dwell upon perceptions of failure (Carver and Scheier 1998; Gaudreau et al. 2002). However, a life span perspective emphasises the adaptive functions that goal disengagement can bring to overall self-regulation across one's life course (Wrosch et al. 2003a; Heckhausen et al. 2010), and benefits include; freeing up time and resources for more important goals, pursuit of goals more aligned with one's own values and the potential for reduced negativity associated with the goal change (Wrosch et al. 2003a). For athletes, goal pursuit and goal disengagement are similarly important and can occur within a much shorter timescale as well, for example, the yearly training cycle, monthly training and competition goals where goal achievement has associations with future perceptions of competence, self-efficacy and anxiety (Treasure et al. 1996) and hence future performance.

The path leading to this goal change or goal disengagement can be complex and emotional. Both effort and commitment are important components of self-regulation which contribute to the decision making process (Wrosch et al. 2003a). Rate of goal progress has been shown to change the affective experience with negative affect increasing where progress towards a desired goal is below expectations (Carver and Scheier 1990; Gaudreau et al. 2002). In situations where individuals give up (for either voluntary or enforced reasons) and reduce their effort whilst remaining committed to a goal, negative affect and distress is experienced (Wrosch et al. 2003a). A cyclist still striving for a now unrealistic target time and a podium position after a crash is likely to experience intense disappointment, but goal commitment may still drive them on. Continued goal striving would demonstrate a poor decision made by the cyclist with a high risk and low reward scenario unfolding (Renfree et al. 2014) which is accounted for at times by the strength of desired goal and its value to the cyclist (Carver and Scheier 1998). However, alternative, more adaptive scenarios are available where individuals disengage from their initial goal *and* give up that goal commitment. Altering goals or goal paths can lead to positive psychological, if not performance, outcomes for the individual in the longer term. These adaptive scenarios include scaling back to a lower goal, choosing an alternative strategy to reach the same goal, or forming a new goal (see Wrosch et al. 2003a for a detailed review). It is these alternative paths that become important when athletes consider their long, mid or short term goals as they provide the opportunity to derive psychological benefits from a more positive self-evaluation and outlook for future performances (Sanchez et al. 2010). In the example of the cyclist crashing, relinquishing commitment to their target time, scaling this back to a more realistic time and re-considering this race within the context of past, current and future performances could provide a much more positive adaptive experience.

Several factors within self-regulation influence whether an individual strives for, or disengages from a goal. Goals which are central to one's sense of self are more difficult to disengage from (Wrosch et al. 2003a), whilst risk : benefit considerations, internal and external information and interpretation of this information can affect an athlete's decisions during competition (Renfree et al. 2014). Furthermore, an individual may experience less distress withdrawing their effort and commitment from their current goal if alternative goals are available to them (Wrosch et al. 2003b). Affective loading (negative affect – positive affect) is postulated to be associated with either the maintenance or reduction of motivation causing a desire to maintain exercise intensity or reduce it (Baron et al. 2011) and unfavourable changes in positive and negative affect can lead to goal termination (Heckhausen et al. 2010). In addition, the strength model of self-control; *"the capacity for altering one's own responses…"* (Baumeister et al. 2007, p.351), demonstrates how actions requiring self-regulation (e.g. controlling thoughts, managing emotions, making choices) can lead to a depleted self-control resource limiting subsequent performance (Baumeister et al. 2007; Dorris et al. 2012; Englert and Beatrams 2014). Some research has also found that a depleted self-control resource (ego depletion) affects an individual's ability to disengage from an unattainable goal *(passive-option effect)* (Baumeister et al. 1998). All of these factors warrant careful consideration within cycle time trials where cyclists are striving for optimal mental and physical performance.

The purpose of this paper was to apply principles of self-regulation and adaptive self-regulation to three case studies. The primary aim was to analyse the changes in affective response that coincide with goal pursuit and goal disengagement as suggested by Wrosch et al. (2003a). A secondary aim was to derive insights into the decisions made by the cyclists during the time trial. To this end the paper seeks to alert readers to new areas for consideration in the analysis of cycling performances whilst providing impetus for the combined study of self-regulation, emotions and decision making in cycling. Practical implications relating to adaptive self-regulation and mental strategies within races are proposed.

Materials and methods

Participants

The individual performances of three well trained male athletes are presented here as separate case studies. Participants were recruited as part of a larger study

assessing repeated laboratory time trial performance and formed a criterion based sample where each fulfilled one of the following criteria: i) successful completion of the time trial reaching their pre-trial goal (successful) ii) unsuccessful completion of the time trial failing to achieve their pre-trial goal but reporting recalculation of goal during the time trial (unsuccessful - recalculation) or iii) unsuccessful completion of the time trial not achieving their pre-trial goal (unsuccessful). Participant 1 (successful) was a 28 year old male triathlete (ht = 1.83m; mass = 75kg) with a personal best (PB) over 20km of 32.04 mins. Participant 2 (unsuccessful - recalculation) was a 50 year old male triathlete (ht = 1.76m; mass = 76kg) whose 20km PB was 27.49 mins. Participant 3 (unsuccessful) was a 26 year old male cyclist (ht = 1.76m; mass = 74.5kg) with a PB of 27.52 mins. Participants had a minimum of 2 years' experience at this and other time trial distances. Institutional ethics approval was obtained prior to study commencement. All participants provided written informed consent and completed health screening questionnaires prior to data collection in accordance with required ethical standards in sport and exercise science research (Harriss and Atkinson 2011).

Procedure

Each participant completed a 20km laboratory time trial with their own bicycle mounted and calibrated onto a Kingcycle ergometer rig (Kingcycle Ltd, High Wycombe, UK). Demographic information together with details of 20km personal best time, pacing strategy for the upcoming trial and time goal were gathered 30 minutes prior to the trial. The participant also provided pre-trial ratings of goal expectancy, their identified pacing strategy and likely achievement of this pacing strategy on a Likert scale 1 *'not at all'* to 10 *'very much so'*. A self-selected warm up commensurate with normal time trial preparation preceded a 5 second countdown. Every 0.5 km during the time trial participants provided verbal reports of affective feeling states on the Worcester Affect Scale (WAS; Rhoden and West, 2010) with positive affect rated from 1 *'not at all positive'* to 10 *'extremely positive'* and negative affect 1 *'not at all negative'* to 10 *'extremely negative'*. Using the same scale as pre-trial, goal expectation was measured at 5, 10 and 15km distances and goal achievement at 20km. During the trial participants were free to utilise self-chosen feedback which included power, time, distance and heart rate and rehydrate as required. Power output (Watts) was recorded every 0.5 km and performance time was recorded at the end of the trial. Ten minutes after the trial a post trial questionnaire obtained i) ratings of goal achievement and achievement of their pacing strategy, 1 *'not at all'* to 10 *'very much so'*, ii) thoughts about their control over the performance, iii) thoughts about their achievement (or lack of) and iv) self-chosen adjectives to describe their within trial feelings.

Analyses

Positive and negative affect, goal expectancy, power in current trial and average power from previous trials were displayed by distance for visual analysis to examine change in affect, goal expectancy and power during the time trial between the successful, unsuccessful - recalculation and unsuccessful scenarios. The time trial was divided into five phases; phase 1 (0 - 5 km), phase 2 (5 – 10 km), phase 3 (10 – 15 km), phase 4 (15 – 20 km) and phase 5 (post trial). Five of the six features of single-case design (SCD) analysis; 'level', 'trend', 'variability', 'immediacy of effect' and 'overlap' were used for the visual analysis of phases 1-4; according to the standards for the visual analysis of single-case research (Kratochwill et al. 2013). The sixth feature, 'consistency of data patterns across similar phases' was not used here as our research was particularly interested in the dissimilarity across the differing scenarios. Within phase analysis included: i) 'level' or mean of each variable during the phase, ii) 'trend' referring to the slope of the line of best fit and iii) 'variability' which was calculated as the standard deviation of the outcome measure about the line of best fit. For between phase analysis, iv) 'immediacy of the effect' was calculated as the change in value between the last three data points of one phase and the first three data points of the subsequent phase (sum of first three data points of a phase – sum of last three data points of previous phase). Larger values represented a more immediate and rapid change in the variable between the different phases of the time trial. Finally, v) 'overlap' was measured by calculating the percentage of non-overlapping data points (PND) between adjacent phases (Gage and Lewis, 2013). Larger values indicate increased change in the variable is observed with little overlap between phases of the trials. Scruggs and Mastropieri's (2001) magnitude criteria was used to interpret PND scores for between phase changes where scores of 90% and above represented very large between phase score changes, 70% - 90% large changes, 50% - 70% moderate changes, and below 50% no change. An additional between phase measure assessing the practical effect of ongoing success or failure between participants based upon goal progress during each phase was effect size (Shadish 2014). This was calculated using the standardised mean difference effect size (SMD) between adjacent phases ([mean of all data points of a phase – mean of all data points of the previous phase] / standard deviation of previous phase) expressed in standard deviation units (Gage and Lewis 2013). The SMD was used to compare the effect of the different goal attainment scenarios both between participants and between dependent variables. In Phase 5, post trial ratings of goal achievement, achievement of pacing strategy, qualitative data and self-chosen feeling state adjectives were also compared between case studies. Self-chosen feeling state adjectives were assessed against mood descriptors used in the Positive and Negative Affect Schedule – Expanded form (PANAS-X; Watson and Clark 1994). The PANAS-X

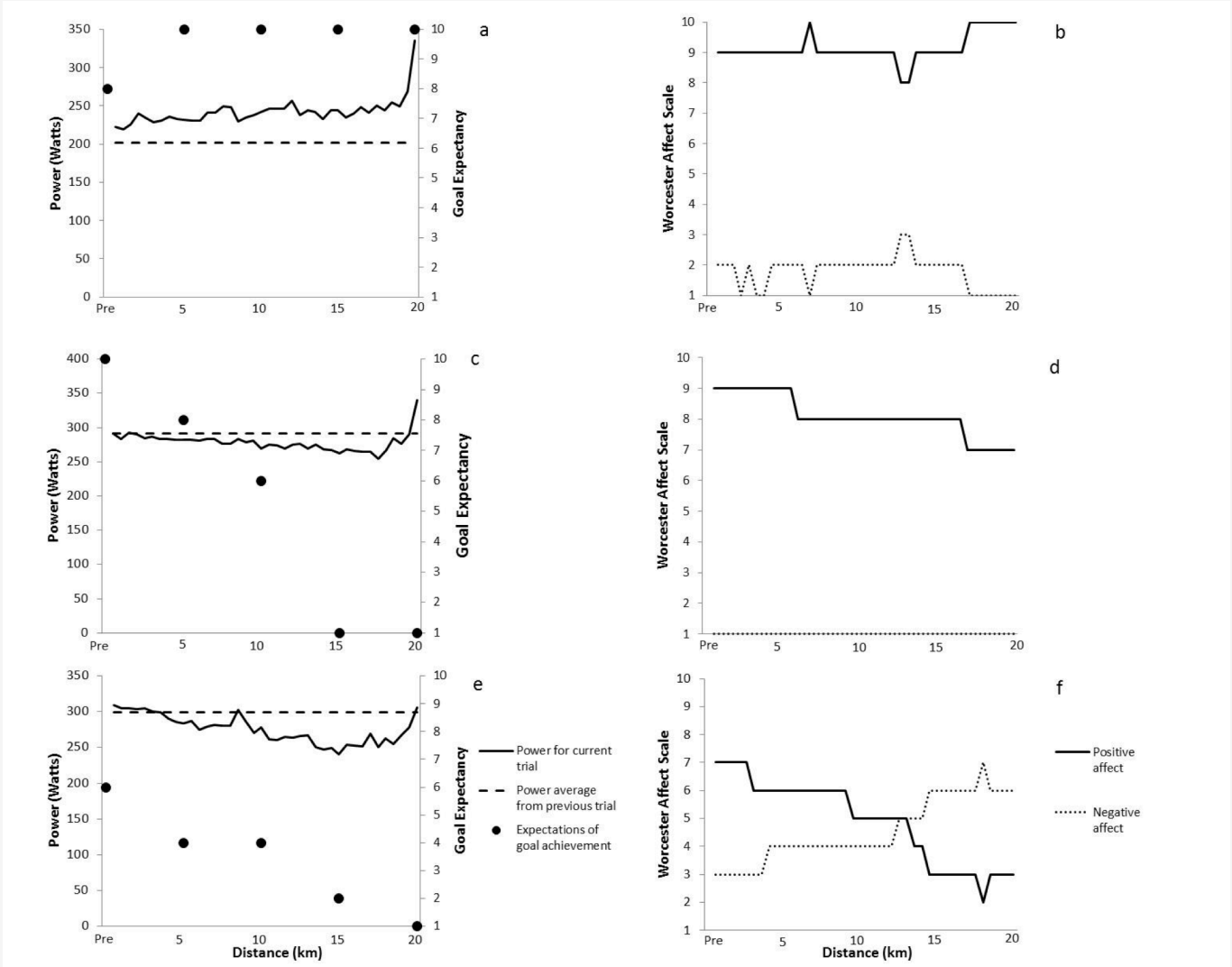

Figure 1. Power, affect and goal expectancy profiles for participant 1 (successful; graphs a and b), participant 2 (unsuccessful - recalculation; graphs c and d) and participant 3 (unsuccessful; graphs e and f).

was developed from the validated framework; the hierarchical structure of affect, which encompasses higher order general dimensions of positive and negative affect and lower order specific affects (Watson 2000). Lower order specific affects include; four basic negative emotions (fear, hostility, guilt and sadness), three basic positive emotions (joviality, self-assurance and attentiveness) and four other affective states (shyness, fatigue, serenity and surprise). Each participant's self-chosen adjectives were matched with items on the PANAS-X to determine which affect dimensions they reported experiencing during the trial.

Results

The three case studies depict three variations of success and failure scenarios. Analysis of the affect, goal expectations and power profiles together with qualitative data of perceptions of performance are used to explain the context of these scenarios and factors occurring in covariance.

Participant 1 (successful)

Participant 1 was successful outperforming his target time of 32.04 mins, achieving a time of 30.14 mins (6% faster) with a power profile consistently higher than his previous time trial average (Figure 1a). An overall positive linear trend in power is additionally supported by the positive SMD values, phase means and trend values (Table 1) which collectively evidence a negative pacing strategy (quicker during the second half of the trial) with some larger oscillations between 0 – 12 km (Figure 1a). Participant 1 achieved a negative pacing strategy as he intended. A greater change in power was observed in the last kilometre evidencing an endspurt. Effect sizes for power output show that participant 1 produced the largest endspurt of all the participants (Phase 4 SMD participant 1(successful) = 2.12, participant 2(unsuccessful-recalculation) = 1.41, participant 3(unsuccessful) = 0.80). Goal expectancy increased at the 5 km distance and remained at maximum levels of expected goal achievement for the remainder of the trial. Positive and negative affect means were stable across the phases with only minor oscillations (trend and variability values, Table 1). A

Table 1. Within and between phase quantitative data for each case study. Between phase data is located in the latter phase cell, for example, data for between phases 1 and 2 is located in Phase 2 cell. Immediacy = immediacy of the effect. PND = percentage of non-overlapping data points. SMD = standardised mean difference effect size.

SCD analysis features		Participant 1 (successful) Phase				Participant 2 (unsuccessful - recalculation) Phase				Participant 3 (unsuccessful) Phase			
		1	2	3	4	1	2	3	4	1	2	3	4
Power													
Within phase	Mean	230	239	244	257	286	280	271	277	299	282	257	265
	Trend	1.28	0.51	-0.81	1.94	-0.95	-0.75	-1.02	5.72	-2.71	-0.10	-2.44	4.16
	Variability	5.5	7.0	5.7	21.5	3.1	3.8	3.5	17.9	3.3	9.3	6.4	12.2
Between phase	Immediacy	-	2	23	2	-	-1	-12	1	-	-20	-48	23
	PND (%)	-	50	10	20	-	60	40	40	-	70	100	30
	SMD	-	1.31	0.77	2.12	-	-1.54	-1.94	1.41	-	-1.91	-3.00	0.80
Positive affect													
Within phase	Mean	9.00	9.10	8.80	9.70	9.00	8.10	8.00	7.30	6.50	5.80	4.40	2.90
	Trend	0	-0.03	0	0.13	0	-0.05	0	-0.13	-0.15	-0.10	-0.24	-0.01
	Variability	0	0.3	0.4	0.3	0	0.3	0	0.3	0.2	0.3	0.4	0.3
Between phase	Immediacy	-	1	0	0	-	2	0	0	-	0	-1	-1
	PND (%)	-	10	0	70	-	90	0	70	-	20	40	10
	SMD	-	0	-0.95	2.13	-	0	0	0	-	-1.33	-3.00	-1.78
Negative affect													
Within phase	Mean	1.70	1.90	2.2	1.30	1.00	1.00	1.00	1.00	3.30	4.00	4.80	6.10
	Trend	-0.01	0.03	0	-0.13	0	0	0	0	0.13	0	0.24	0.01
	Variability	0.5	0.3	0.4	0.3	0	0	0	0	0.3	0	0.3	0.3
Between phase	Immediacy	-	-1	0	0	-	0	0	0	-	0	0	1
	PND (%)	-	0	20	70	-	0	0	0	-	0	60	10
	SMD	-	0.41	0.95	-2.13	-	0	0	0	-	1.45	0	1.65

Table 2. Pacing and affect responses pre- and post trial for each case study.

	Participant 1 (successful)	Participant 2 (unsuccessful - recalculation)	Participant 3 (unsuccessful)
Pre-trial			
Targeted pacing strategy for trial	Negative	Even	Negative
Post trial			
Rating of goal achievement	10	1	1
Achievement of pacing strategy	9	1	1
Did you feel in control of the performance?	Yes	Yes	No
Perceptions of (lack of) achievement	"Confident I could go harder"	"Internal reasons - knew I could not make the goal so recalculated"	"Legs were tired and fatigued a lot during the test"
Self-chosen feeling state adjectives	*Strong* [a] Fit *Determined* [a] *Interested* [a] *Concentrated* [a] *Active* [a]	*Determined* [a] *Focused* [a] Challenged *Interested* [a]	*Disappointed* [b] *Tired* [c] *Fatigued* [c] Slow Poor *Unexpected* [d]
Categorisation of feeling state adjectives	Positive affect	Positive affect	Negative affect Fatigue Surprise

Note: Self-chosen feeling state adjectives in *italics* indicate those which matched items on the PANAS-X. [a] items matched with general dimension of positive affect or basic positive emotions, [b] items matched with general dimension of negative affect or basic negative emotions, [c] items matched with other affective state 'fatigue', [d] items matched with other affective state 'surprised'.

high PND between phases 3 and 4 together with the large positive SMD highlight the increase in positive affect toward the end of the trial to maximum scores. Negative affect mirrored positive affect with a decline towards the end of the trial. Qualitative data aligned with graphed data with participant 1 feeling in control of the performance. Self-chosen adjectives (e.g. *strong, determined, interested*) matched general positive affect and basic positive emotion items revealing participant 1 experienced positive affect during the trial whilst also having the belief he *'could go harder'* during the trial

(Table 2). Overall a strong, positive and stable time trial was evident.

Participant 2 (unsuccessful - recalculation)

Participant 2 was unsuccessful performing slower than his target time of 27.49 mins achieving a longer than expected time of 28.45 mins (~3.5% slower). Post trial, participant 2 reported recalculating his goal (to beat his previous time) upon realising his goal was unattainable due to internal reasons (*'...knew I could not make the goal so recalculated'*). We highlight here the changes in power, affect, goal expectation during the trials combined with the post trial data which demonstrate goal pursuit and goal recalculation. Although starting the trial with the same power as the average power from a previous trial (~300W), participant 2 experienced a continual decline in power, notwithstanding some minor oscillations, to 18 km (Figure 1c; Trend phase 1= -0.95, 2 = -0.75, 3 = -1.02, Immediacy phase 2-3 = -12, Table 1). Phase 3 power mean was ~30W below his previous average (Table 1). The negative linear trend in power is further supported by the decrease in SMD values by almost 2 standard deviations between phase 2 and 3, a direct contrast to participant 1 at the same stage (Table 1). This decline in power is paralleled by a large decrease in positive affect (2 units, Figure 1d) from phase 1 to 2 (90% PND) and a large decrease from phase 3 to 4 (70% PND). Participant 2 (unsuccessful - recalculation) reported a lack of achievement of pacing strategy producing a positively paced trial after stating his aim was for even pacing (Table 2). Negative affect was at the lowest levels possible throughout the trial. Perceived goal expectations mirror the positive affect and power decline with a reduction from 10 *'very high'* levels of perceived goal achievement pre-trial to 1 *'very low'* perceived goal achievement by 15 km (Figure 1c) and post trial (Table 2). Despite the declining positive affect, power and goal expectancy levels, participant 2 reported feeling in control of the performance perhaps because he recalculated his goal when it became apparent that his original goal was unattainable (Table 2). Similar to participant 1 (successful), participant 2 reported experiencing positive affect and basic positive emotions during the trial (self-chosen adjective feeling states reported; *determined, focused, interested*, Table 2). Whilst unsuccessful with a moderate decline in positive affect in this trial, a recalculated goal together with positive feeling states were reported by the participant in this scenario.

Participant 3 (unsuccessful)

Participant 3 was unsuccessful failing to reach his target time of 27.52 mins, recording a time of 28.32 mins (~3% slower). At the start of the trial Participant 3 had a power output 10W above his previous trial average (Figure 1e). However this declined rapidly to 6 km with large effect sizes between phase 1- 2 (SMD phase 1-2 = -1.91; Trend phase 1 = -2.71, 2 = -0.1). An attempt to regain early trial power output (~300W) occurs between 8-9km but this was unsustained and an immediate decline in power continues to 16km (Phase 3 Immediacy = -48, trend = -2.44, phase 2-3 SMD = -3.00, Table 1). Comparing between participants, effect sizes for changes in power during the time trial were greatest for participant 3 (Table 1). As with participants 1 (successful) and 2 (unsuccessful - recalculation), positive and goal expectancy values covaried and for participant 3 they declined consistently throughout the trial. Furthermore, participant 3 also experienced a much larger decline in positive affect (5 units, Figure 1d) compared to participant 2 (2 units; Figure 1f) with very large effect sizes across phases 1 to 4 (range -1.33 to -3.00). There was also a corresponding increase in negative affect for participant 3 and this is in contrast to the negative affect levels reported by participant 2 (unsuccessful - recalculation). Large increases in negative affect reach a critical point at 13.5km where participant 3 started to report higher levels of negative affect than positive affect (negative affect PND phases 1-2 = 60%, Figure 1f). Effect sizes showed the largest reductions occurred in power output and positive affect with negative affect increasing but to a lesser extent (SMD power output = -3.00, positive affect = -3.00, negative affect = 1.65, Table 1). Similar to participant 2 (unsuccessful - recalculation), participant 3 reported an absolute lack of pacing strategy achievement producing a positively paced trial yet aiming for and negative pacing profile. Furthermore, participant 3 did not feel in control of his performance and self-chosen adjectives aligned with basic negative emotions (*disappointment*) and lower order affective states of fatigue (*tired*, *fatigued*) and surprise (*unexpected*) (Table 2). In summary, participant 3 experienced a negative and disappointing time trial that failed to meet his expectations.

Discussion

In this case study report, criterion sampling enabled the visual analysis, comparison and explanation of three different variations of success and failure in competitive time trials with the primary purpose of applying self-regulation and adaptive self-regulation to understand these differences. A key finding from this analysis was the consistent tracking between positive affect and goal progress across the three different participants and scenarios consistent with goal progress and affect relationships in self-regulation (Carver and Scheier 1998). In the successful trial (participant 1, successful) goal progress that was in line with expectations was congruent with increased or maintained positive affect (Gaudreau et al. 2002; Carver and Scheier 2013). Additionally, feelings of control, competence and positive feeling states accompanied the goal progress (Treasure et al. 1996) with successful implementation of a negative pacing strategy supporting the link between internal dynamics (physiological information) and ongoing decision making (Renfree et al. 2014). With manageable physiological disruption occurring, participant 1 (successful) experienced a high reward, low risk scenario and optimal levels of positive and negative affect which led to successful goal striving. Affect

responses post trial were positive and in accordance with self-regulation theory (Wrosch et al. 2003a) leading to increased self-efficacy (Treasure et al. 1996) with participant 1 (successful) reporting he was confident he could put more effort in (*"Confident I could go harder"*).

Positive affect similarly tracked goal progress in unsuccessful trials (participant 2 successful and 3, unsuccessful - recalculation) in which lack of goal progress was paralleled with decreased positive affect (Carver and Scheier, 1998; Rhoden et al. 2014). There is, however, an additional element to consider when comparing the unsuccessful trials of participants 2 (unsuccessful – recalculation) and 3 (unsuccessful), which denotes a further key finding of this study; the impact of goal disengagement. Perceived control and reported feeling states were very different between these two participants. The basic negative emotions (Watson and Clark 1994) reported by participant 3 (unsuccessful) who, unlike participant 2 (unsuccessful – recalculation), did not recalculate his goal is indicative of the resultant affective states that ensue when goal progress deteriorates but goal commitment is maintained (Wrosch et al. 2003a). Several interrelated factors may be responsible for his lack of success. Participant 3 (unsuccessful) whose aim was for a negative pacing strategy, started the time trial with lower positive affect and higher negative affect than participant 1 (successful) or 2 (unsuccessful – recalculation) and had a moderate expectation of goal achievement at the outset of the trial. These initial conditions suggest a sub-standard psychological profile for effective time trial performance (Heckhausen et al. 2010; Renfree et al. 2012). The initial, and then continued decline in power output and lack of goal progress was perhaps the result of peripheral physiological fatigue from the pursuit of an unsustainable muscular work rate as participant 3 (unsuccessful) reported high levels of fatigue and tired legs post trial (Renfree et al. 2012; Renfree et al. 2014). Critically, participant 3 (unsuccessful) reported higher negative affect levels than positive affect from 13 km onwards with affective loading peaking at 18 km reducing his motivation and effort still further (Baron et al. 2011). Failure to fulfil a negative pacing strategy coupled with declining expectations of goal achievement made participant 3 (unsuccessful) more aware that his progress towards his goal was lower than expected (Carver and Scheier 1998). Self-regulation predicts that continued yet futile goal striving is hypothesised to lead to feelings of negative affect and distress (Wrosch et al. 2003a) and this is seen clearly throughout the trial. In spite of this, participant 3 (unsuccessful) failed to modify the unfolding 'high risk, low benefit' scenario. It is possible he made a poor decision to goal strive (Renfree et al. 2014) or indeed failed to recognise the situation as surprise and loss of control were reported post trial. It is also possible that participant 3 (unsuccessful) experienced ego-depletion. Tasks such as controlling thoughts and managing emotions require self-control and they are important processes within self-regulation (Baumeister et al. 2007). The declining scenario experienced by participant 3 (unsuccessful) was likely to have required a high level of mental effort to manage. Upon ego-depletion, the subsequent decline in performance may have been caused in two ways. Firstly, ego-depletion has been shown to reduce subsequent physical performance (Dorris et al. 2012; Englert and Bertrams 2014). Secondly, participant 3 (unsuccessful) was unable to disengage from his unattainable goal due to the passive-option effect; when individuals experience a loss of self-control strength they often opt for the easiest course of action which in some cases is striving for unattainable goals (Baumeister et al. 1998).

Applying the principles of adaptive self-regulation theory further, affective states are predicted to remain positive where an individual maintains effort but relinquishes goal commitment (Wrosch et al. 2003a). We see this occurring for participant 2 (unsuccessful – recalculation) who recognised that failure to achieve his goal was inevitable. Decision making theory alludes to the underpinning processes whereby some decisions encompass an assessment of the risks (e.g. physiological disruption) and benefits (e.g. achievement of a PB, goal or win) of a course of action (Renfree et al. 2014). Assessing either the current level of physiological strain as unsustainable or the goal unachievable, i.e. the risk outweighed the benefits, participant 2 (unsuccessful - recalculation) reduced effort, employed an adaptive self-regulatory strategy to recalculate and scale down to a lesser goal, therefore counteracting the potential negative effects of failure. This was corroborated by the moderate decline in positive affect and the positive post trial affective states (self-chosen adjectives) which contrast sharply with the severe decline in positive affect and post trial negative affective states seen in the profile of participant 3 (unsuccessful). Wrosch et al. (2003b) emphasised that the availability of alternative goals enables an individual to disengage from unattainable goals more and allowed an adaptive self-regulation strategy to play out in this case. We are however, unable to report whether participant 3 (unsuccessful) did not have alternative goals available. Wrosch et al. (2003b) research was in the context of longer term goals. Its feasibility in short term sporting contexts requires further larger scale investigation than that in the present study. Furthermore, the exact reasons for, and the threshold point at which participant 2 (unsuccessful – recalculation) opted to disengage from his goal rather than continue goal striving cannot be determined here and is also encouraged within future research.

Adaptive self-regulatory strategies have been proposed and employed within the context of a person's lifespan (Wrosch et al 2003a) and their application to goal pursuit and goal achievement in the sport and exercise context would be of value. In particular, the identification of, and then decisions about whether to strive for or disengage from a goal whilst 'in the moment' was proposed as a key area for the future (Heckhausen et al. 2010) which we would endorse and

advocate for both research and practical contexts. Whilst the factors surrounding the decision to 'strive or not strive' are not specifically identified or measured here, some indications from these case studies include the extent of feelings of control, the ability of the athlete to make accurate assessments of physical capacity, goal importance and personality. Further examination of goal type, multiple goals (Shah 2005) and goal hierarchies and their impact upon goal pursuit and goal disengagement is also encouraged. Wrosch et al. (2003b) highlights that goal disengagement depends upon the availability of alternative goals whilst Carver and Scheier (2013) propose that a strengthening of either positive or negative affect may lead to a change in goal priority. By applying self-regulation and adaptive self-regulation in a case study context, this paper provides evidence for the adaptive functions of goal disengagement whilst highlighting the importance of behavioural and psychological components involved in decision making surrounding goal striving. We would encourage larger empirical based studies which investigate the effects of goal re-engagement and its longer term implications in the context of sport more fully.

Practical applications

Two important implications arise from this case study analysis. Firstly, the recognition of the potential benefits of goal change, recalculation and / or goal disengagement (Wrosch et al, 2003a; 2003b). Lack of goal achievement need not always be viewed as failure and recognition of the potential for positive adaptation can come from a change in effort and commitment to goals. This knowledge could be a beneficial adjunct to interdisciplinary monitoring during training where adaptive self-regulatory strategies would ensure continued commitment, perceived competence and motivation towards long term goals within a maintained positive environment. Used carefully this approach has the potential to attenuate the onset of overtraining and burnout. Secondly, this information supports the potential use of mental strategies to combat the negative declines in psychological state during competition. Whilst advocating these strategies we recognise and acknowledge the competitive mindset of athletes; it might be very easy to tell someone that goal disengagement would be beneficial, however getting athletes to fully commit to such an approach is a different reality altogether. With intermittent use within the context of long term goals and gains, together with a considered approach to both the mental and physical preparation of this athlete, we feel that an athlete would come to understand and evaluate when giving up could be an alternative and beneficial strategy.

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