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Psychological Strategies to Resist Slowing Down or Stopping during Endurance Activity: An Expert Opinion Paper

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Abstract

Within this paper, we provide an expert opinion on five evidence-based psychological strategies that could help endurance participants overcome slowing down and stopping during performance: goal setting, motivational self-talk, relaxation, distraction, and pacing. We argue that these strategies are well-suited for delivery as brief-contact, educational interventions that could be accessible to large numbers of participants who do not have access to a sport and exercise psychologist. These interventions could be delivered using websites, online videos, workshops, or magazine articles. We propose a novel use for implementation intentions (i.e., if-then planning) to develop endurance participants' conditional knowledge of when to use specific strategies. In addition, although research evidence suggests that these psychological strategies may be efficacious for overcoming thoughts of slowing down or stopping, there are important limitations in the research evidence. In particular, there is a dearth of ecologically valid, field-based effectiveness studies. Finally, we consider situations where attempts to resist slowing down or stopping during endurance activity may not be advisable. Scenarios include when there is an increased likelihood of injury, or when environmental conditions increase the risk of life-threatening events.

Keywords: Brief-contact interventions; endurance performance; if-then planning; psychological skills training; self-regulation.

Endurance Activity and Resisting Slowing Down or Stopping

Endurance activities involve performing continuous, dynamic, and whole-body exercise tasks (e.g., running, cycling, swimming, rowing) over middle or long distances, at submaximal intensities (McCormick et al., 2019). Sport (e.g., competitive cycling) and exercise events (e.g., mass-participation running events) that involve endurance are exceptionally popular (e.g., Scheerder et al., 2015), and include participants who range from non-competitive and inexperienced levels through to competitive, elite athletes (McCormick et al., 2020). Endurance participants and athletes often experience thoughts about slowing down significantly (e.g., walking in a running event) or stopping (e.g., momentarily taking a break or quitting the event) during endurance activity (Buman, Omli, et al., 2008; Cooper et al., 2020; Meijen et al., 2018; Schüler & Langens, 2007). Although slowing down or stopping may seem rational behavioural responses to exertion, pain, and discomfort, often such actions are unintentional and have unwelcome effects on performance (Buman, Brewer, et al., 2008). Phenomenological accounts of participants wanting to slow down or stop during endurance activity suggest that, although an unpleasant experience, using specific psychological strategies can help participants resist slowing down or stopping and maintain a higher level of performance (Buman, Brewer, et al., 2008; Cooper et al., 2020).

This expert opinion paper is an output of a British Psychological Society Division of Sport and Exercise Psychology funded Research Working Group. These Working Groups "bring together experts from within a research area to foster greater collaboration" and look to "progress a specific research area within sport and exercise psychology" (British Psychological Society, 2021). The Working Group that wrote this opinion paper has shared research expertise in the psychology of endurance performance and, within this paper, aimed to progress research and practice in the endurance context.

As such, the purpose of this expert opinion paper is to provide an overview of evidence-based psychological strategies that may help endurance participants to keep going in circumstances where there is no apparent risk of injury, harm, or threat to life. The chosen strategies were agreed based on critical discussion of the evidence base by seven endurance psychology researchers in the Working Group. The Working Group aimed to select and include research on strategies that met the following criteria:

- Psychological strategies
- Deliverable as brief-contact, educational interventions
- Grounded in good quality research evidence (e.g., see the systematic review by McCormick et al., 2015)
- Likely to benefit athletes in the 'real world', and unlikely to harm (e.g., increase risk of injury), when delivered as brief-contact, educational interventions

Consequently, we have confined our overview to *psychological* strategies rather than including all interventions such as those deriving from ergogenic aids like caffeine (see Southward et al., 2018 for a review) or behavioural interventions such as listening to music (see Terry et al., 2020 for a review). The focus of this expert opinion paper is on brief-contact, educational, psychological interventions (referred to as brief-contact interventions) that can make evidence-based sport psychology more accessible and implementable. We define brief-contact educational interventions as those providing content that the user should be able to understand in a single session. The consultant's role is educational, and the intervention can be delivered by sport psychology trainees or individuals with a strong grounding in sport psychology, such as individuals with a (Stage

1) master's degree in sport psychology. This makes brief-contact educational interventions different from approaches such as solution-focused therapy, where although the contact with the practitioner may be limited to one session (e.g., de Shazer et al., 2007) it is expected that the provider of the solution-focused therapy is competent in a counselling model of delivery, which can be expected of sport and exercise psychology practitioners who have further training and experience (e.g., registered Sport and Exercise Psychologists; British Psychological Society, 2018).

Psychological interventions can include teaching psychological strategies, where endurance participants are educated about how the strategy can benefit them in the future (Meijen, 2019). In this overview, when we use the term 'psychological strategies', we refer to a single psychological technique (such as self-talk, goal setting) or a combination of techniques, that can be used systematically to enhance a psychological skill such as attention, coping, or confidence (see also Birrer & Morgan, 2010).

In terms of accessibility, we suggest that brief-contact interventions may benefit endurance participants who do not have access to a sport psychology practitioner for continued sport psychological support (McCormick et al., 2020); this is a consideration particularly relevant to participants in mass-participation events (e.g., major city marathons). Consequently, providing brief-contact interventions may reduce barriers to psychological knowledge and support (Meijen et al., 2017). In terms of implementation, we suggest that evidence-based, brief-contact interventions that require minimal time may–within the sport psychology domain–provide a novel, practical, and wider-reaching approach to positively impact endurance performance (McCormick et al., 2020). Before we appraise brief-contact interventions that can be applied to endurance activity, we first provide a short overview of why athletes might slow down or stop from a physiological and psychological perspective.

Stopping Endurance Exercise: Mind over Muscle?

In exercise physiology, it has traditionally been assumed that highly motivated people have to slow down or stop during endurance activity because their fatigued neuromuscular system is no longer able to produce the desired power/speed required despite a maximal voluntary effort (Allen et al., 2008; Hepple, 2002). However, in recent years, this assumption has been challenged by studies demonstrating the existence of a significant neuromuscular and bioenergetic reserve after exhaustive endurance exercise (Cannon et al., 2016; Marcora & Staiano, 2010; Morales-Alamo et al., 2015; Staiano et al., 2018). These findings suggest that even highly motivated people reach their "psychological limit" before reaching the limit of their physiological capacity, as originally proposed by Ikai and Steinhaus (1961). More recently, it has been proposed that highly motivated people stop when they perceive their effort as maximal and when continuation of endurance exercise at the desired power/speed seems impossible (Marcora & Staiano, 2010; Staiano et al., 2018). As such, perception of effort is considered a key psychological variable for pacing-related decisions because it is associated with the time people can (or estimate they can) continue to perform endurance exercise at a given intensity (Coqart et al., 2012; Horstman et al., 1979). Perception of effort is also sensitive to a variety of factors known to influence the capacity of humans to sustain endurance exercise. These factors include physical training (Ekblom & Goldberg, 1971), muscle fatigue (Marcora et al., 2008), environmental conditions (Levine & Buono, 2019), mental fatigue (Marcora et al., 2009), and stimulants like caffeine (Smirmaul et al., 2017). Furthermore, thoughts about slowing or stopping—termed a psychological crisis in the endurance performance literature—may occur independently of physiological processes (e.g., due to boredom or self-doubt) and can be managed more effectively using situationally-appropriate psychological strategies (Schüler & Langens, 2007). Therefore, psychological interventions can improve endurance performance by changing how participants perceive their effort, manage discomfort, and regulate their responses to psychological crises to cope with the demands of endurance activity (McCormick et al., 2015).

Brief-Contact, Educational Interventions

Our approach in this paper reflects a psychological skills training model of practice (rather than a counselling or medical model of practice), where the consultant role is educational (rather than clinical), and where the intervention goals or focus broadly relate to the development of psychological skills and benefits to performance (e.g., improving performance time or satisfaction with performance, Poczwardowski et al., 2004). In the context of this opinion paper, we propose that brief-contact, educational interventions consist of psychological strategies delivered in a manner that are easy to learn and subsequently implement. We suggest that brief-contact educational interventions provide content that the user should be able to understand in a single psycho-educational session.

Brief-contact interventions can focus on changing thoughts and feelings experienced during normal, everyday activities (Walton, 2014). As such, brief-contact interventions can be underpinned by self-regulatory processes; that is, ‘self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals’ (Zimmerman, 2000, p. 14). When individuals self-regulate, they plan, execute their plans, and subsequently reflect on the effectiveness of those plans

(Zimmerman, 2000). These phases are referred to as the forethought, action, and reflection phases of self-regulation (Zimmerman, 2000). Critically, effective self-regulation requires knowledge of appropriate task strategies (i.e., evidence-based psychological strategies to overcome unhelpful thoughts and behavioural urges) and conditional knowledge of when to use them (Brick et al., 2016; Cleary et al., 2006). In this regard, recent evidence with beginner endurance participants suggests that declarative, procedural, and conditional knowledge of psychological strategies is mostly acquired from other athletes and coaches (Brick et al., 2020). Thus, coupled with a lack of access to sport and exercise psychologists (McCormick et al., 2020), consultancy models focused on establishing a relationship, identifying and formulating the needs of the client, delivering an intervention, and evaluating the service (e.g., Keegan, 2016) may be less likely to reach and benefit this population. Consequently, we feel it is important to draw attention to brief-contact interventions relevant to endurance contexts that are time-limited, action-oriented, and can be shared by people who are not accredited sport and exercise psychologists, including trainee practitioners and appropriately trained coaches, sport scientists, and sport therapists (Giges & Petitpas, 2000; Meijen et al., 2017).

There are a variety of ways to deliver brief educational interventions for endurance participants. Coaches, sport scientists, or sport therapists might include relevant content during face-to-face individual sessions. In addition to these modes of delivery, sport and exercise psychologists may also include content more widely online (e.g., website articles, videos), in print (e.g., magazine articles), and through group workshops (Cotterill & Symes, 2014), and make these resources available to use by coaches, sport scientists, sport therapists, and endurance participants. Brief-contact interventions have also been delivered using a ‘psyching team’ model involving group workshops and the provision of brief one-to-one support. Psyching teams originated in Northern America and assist endurance participants prior to, during, and/or after mass-participation endurance events through mental skills support (Gibbs-Nicholls et al., 2022; Hays & Katchen, 2006; Meijen et al., 2016). Importantly, these different options complement each other by catering for different participant preferences (McCormick et al., 2020). Moreover, exposing endurance participants to sport psychology may initiate subsequent one-to-one consultancy (Hays & Katchen, 2006) through increased visibility of sport psychology. As such, we do not suggest that brief-contact interventions *replace* individual sport psychology support, but instead can provide a useful *additional* mode of providing sport psychology information in contexts where the support required is performance-driven and non-clinical in nature.

The provision of easily accessible sport psychology information as brief-contact interventions is intuitively appealing. Nevertheless, there remains a need to demonstrate efficacy and effectiveness, and to develop evidence-based resources for intervention content. This is particularly the case for online, social, and print media sources, where non-evidence-based, pseudoscientific misinformation may be prevalent (Bailey et al., 2018). This issue can impact on the quality of intervention content, particularly for sports coaches who commonly use online sources to obtain information about psychological strategies and ‘tips’ (Pope et al., 2015). Similarly, recreational endurance participants have reported a preference for psychological guidance provided through online sources as well as through sport-specific magazines, through their coach, and through event organisers (McCormick et al., 2020). Consequently, we will also critique the evidence for the ‘real-life’ effectiveness of psychological strategies to overcome slowing down and stopping during endurance activities. Next, based on the expertise of the working group and the criteria set out at the start of this paper, we turn our attention to five evidence-based psychological strategies deliverable as brief-contact, educational interventions: goal setting, motivational self-talk, relaxation, distraction, and pacing, judgement and decision-making. After outlining these psychological strategies, we propose that implementation intentions (i.e., if-then planning) could be used to develop endurance participants' conditional knowledge of when to use specific strategies.

Goal Setting

Most endurance participants appear to engage in goal setting to some extent (Weinberg, 1999). Indeed, it is common for endurance participants to set performance-focused goals to improve, such as completing an event in a personal best time (Hardy & Nelson, 1988; Martin & Gill, 1995; Masters & Ogles, 1998; Ogles & Masters, 2003), and there is experimental evidence for the benefits of this in research involving self-paced (Tenenbaum et al., 1999) and incremental endurance tasks (Theodorakis et al., 1998). Other types of goals typically adopted are outcome goals (e.g., finishing in the top three positions) and process goals (e.g., focused on implementing skills and strategies).

Setting goals can benefit endurance participants by increasing motivation and directing attention. As such, goals play an important role in the regulation of behaviour (Locke & Latham, 1985) and are an essential component of effective self-regulation (Zimmerman, 2000). Goals can, however, also act as stressors (Burton & Naylor, 2002). Specifically, perceived goal difficulty can impact pre-competition states and more difficult goals have been associated with higher pre-competition anxiety in swimming (Hanton & Jones, 1995), middle distance running (Jones et al., 1990), duathlon (Lane et al., 1995a), and triathlon (Lane et al., 1995b) events. Furthermore, goal setting guidelines suggest that goals should be challenging, yet attainable (Locke & Latham, 1985). The line between attainable and unattainable can be fine, however. Specific to endurance performance, Burdina et al. (2017) noted that when runners went up an age category (specifically runners who moved into the 45-49 and 50-54 age groups), and thus had a challenging, yet more attainable goal to aim for in qualifying for a major marathon (Boston), they seemingly performed better. Thus, it is relevant to consider how to address the setting of goals that are potentially too challenging.

It is also common for individuals to have a time-based (performance) goal (Scholz et al., 2008), that often reflects a personal best, that is, their best ever achievement. Performance goals can be beneficial to shape the training required to achieve a standard; setting the sessions and identifying how a session will be evaluated, for example. This is, however, less useful on race day as an excessive focus on performance goals can take the focus away from the task at hand (i.e., process goals) and does not easily allow for adaptability to changing conditions. Weather conditions, such as high temperatures, for example, have been found to negatively affect goal attainment (Markle et al., 2018). To allow for more flexibility (Gould, 2010), endurance participants can instead plan for more adaptability in their goals, which could involve evaluating the conditions on the day and setting different levels of goals. For example, they can set a ‘dream goal’, which is achievable when the conditions on the day are perfect, a ‘happy goal’ for when conditions are less than optimal, and an ‘acceptable goal’ (i.e., a bare minimum) for when circumstances are not as expected (Day, 2019; Markle et al., 2018; Meijen et al., 2017). On race day, this can reduce pressure when individuals feel that their goal is being threatened (Uphill & Jones, 2007), and help control negative thoughts (e.g., of slowing or stopping), and unhelpful emotional responses such as disappointment (Gaudreau et al., 2002; Meijen et al., 2017). In this context, 'open goals', such as 'see how fast I can run 5km' (Swann et al., 2020) can be considered and there is some initial evidence from the physical activity domain to suggest that open goals may facilitate favourable perceptions of performance (Hawkins et al., 2020; Swann et al., 2020). Thus, setting adaptable goals may alleviate performance pressure and benefit participants' well-being. This is especially important given the link between setting unattainable goals and lower well-being (Nicholls et al., 2016). To illustrate, Beedie et al. (2012) found that when research participants were deceptively informed that they were behind their performance goal, they experienced unpleasant emotions and negative thoughts as a result. However, when the same participants were deceptively informed that they were ahead of their goal, they experienced more pleasant emotions and positive thoughts. An important aspect of this process is that endurance participants make decisions on the relative difficulty of achieving the goal without detail of course condition, which has an impact on pacing decisions. Ensuring flexibility is therefore a key aspect when setting a performance standard as a goal.

As such, we propose that brief-contact goal setting interventions should aim to help athletes move away from focusing too much on one single performance (time-based) or outcome (finishing place) goal that is too challenging. Instead, developing goal flexibility and focussing on more controllable, process goals during an event can increase athletes' perceptions of control and, in turn, increase the likelihood of experiencing a challenge state that leads to more positively valanced emotions, increased self-regulatory resources, and enhanced decision-making (e.g., pacing; Jones et al., 2009; Meijen et al., 2020). From an applied perspective with endurance participants, however, it is also important to consider that some people may find it difficult to give up personal goals

(Brandstätter et al., 2013), and endurance participants regularly use performance goals to help track their training progress. Thus, another brief-contact goal setting intervention that endurance participants can consider using to prevent a sole focus on outcome and performance goals is to mentally break up a race or long run into pieces, a strategy sometimes called chunking, where participants set a different process goal for each segment (Brick et al., 2016; Brick et al., 2019; McCormick et al., 2019). With regard to conditional knowledge, an endurance participant may focus more on a process goal to regulate their pace during the initial stages of a race to avoid going too fast (see *pacing, judgement and decision-making* section), for example. In contrast, in the latter stages they might set a process goal to maintain motivational self-talk (e.g., "Come on! Keep it going!") to manage effort, discomfort and to optimise pace.

Motivational Self-Talk

Self-talk refers to what people say to themselves either silently in their head or aloud (Hatzigeorgiadis et al., 2014; Latinjak et al., 2019). This self-talk may relate to wanting to stop or slow down, particularly when performing at a high intensity or for longer durations (McCormick & Hatzigeorgiadis, 2019). Researchers have mostly examined three clusters of self-talk research questions in the endurance context; they have described the self-talk that endurance athletes use, explored the factors that shape and determine endurance participants' self-talk, and examined the effects of strategically using planned self-talk statements on endurance performance (McCormick & Anstiss, 2020; McCormick & Hatzigeorgiadis, 2019). The latter cluster of research is particularly relevant to this overview, and it provides considerable evidence that using motivational self-talk strategically can benefit endurance performance. Strategic use of motivational self-talk can be taught using brief-contact interventions without in-person support

(McCormick et al., 2018a) and is therefore well suited for brief educational interventions (Brick et al., 2020; McCormick et al., 2020).

Strategic self-talk is a strategy where self-talk statements or cue words are deliberately planned and then used (Latinjak et al., 2019). These self-talk statements can be broadly categorised as instructional self-talk and motivational self-talk. Instructional self-talk refers to when people use self-talk to provide instruction relating to technique or form (e.g., "Drop your shoulders"), strategy (e.g., "Time to pick up the pace"), movement qualities (e.g., "Rhythmic pedalling"), or what to pay attention to (e.g., "Watch them going for the overtake", Hatzigeorgiadis et al., 2014). Motivational self-talk refers to when people use self-talk to psych up (e.g., "Come on – Let's do this!"), maximise effort (e.g., "The end's in sight – One last push!"), build confidence (e.g., "You're doing great – Keep this up"), or achieve a desired feeling state (e.g., "Feeling good so far"). Experimental research supports the efficacy of motivational self-talk for improving endurance performance. Motivational self-talk has been shown to increase cycling time to exhaustion in normal conditions (Blanchfield et al., 2014) and in the heat (Wallace et al., 2017), improve performance times in a 10 km cycling time trial (Barwood et al., 2015), and increase distance cycled in 30 minutes in the heat (Hatzigeorgiadis et al., 2018). A motivational self-talk intervention did not improve performance in a 60-mile ultramarathon, however, although most participants reported finding the intervention helpful and continued to use it six months after their research commitment (McCormick et al., 2018a). When compared against instructional self-talk, recent evidence showed that motivational self-talk relating to effort improved amateur triathletes' self-paced, 750m swimming times by 2.8%, whereas instructional self-talk related to pace and movement fluency did not influence performance (de Matos et al., 2021). *How* motivational self-talk is said may also influence performance. Recent research (Hardy et al., 2019) showed that when recreational exercisers used motivational self-talk in a third-person pronoun perspective (e.g., “You can do this”, “You’re hanging in well”) during a 10 km cycling time trial, they performed 2.2% faster than when they used similar self-talk in a first-person perspective (e.g., “I can do this”, “I’m hanging in well”).

Research findings generally suggest that motivational self-talk is a useful psychological strategy for resisting slowing down or stopping. Particularly relevant to this paper, Schüler and Langens (2007) examined the effects of using self-talk during a psychological crisis in a marathon. They argued that a psychological crisis is characterised by strong desire to give up, and thoughts about the benefits of stopping (e.g., resting, relaxing) and the costs of continuing (e.g., unbearable exhaustion), and typically occurs after 30 km. Schüler and Langens (2007) found that self-talk relating to self-encouragement (e.g., “Stay on. Don’t give up”), anticipation of positive consequences (e.g., “I will be proud of myself if I can do it”), and self-calming (e.g., “Stay calm and you will do it”) were effective at buffering against the negative effects of a crisis on performance for runners who experienced a big psychological crisis. More recently, this was echoed by DeWolfe et al. (2021) who found that adding a challenge-focused self-talk statement to a negative self-talk statement, such as ‘My legs are tired, but I can push through it’, was beneficial in the last five minutes of a 20-minute constant duration test, compared to the negative self-talk statement only.

There is a surprising lack of research examining the effects of instructional self-talk on performance in endurance sports, given that each of the functions of instructional self-talk (i.e., relating to monitoring or controlling technique, form, strategy, movement qualities, and attention) have performance implications (Brick et al., 2014). Brief-contact cues to help participant relax both before and during activity have received some attention in the endurance literature, however.

Relaxation

One of the earliest qualitative studies to investigate the psychological strategies engaged by endurance athletes suggested that elite runners focused on bodily sensations and used this information to adjust their pace and "relax or stay loose" during competitive events (Morgan & Pollock, 1977, p. 390). Subsequent laboratory-based, experimental studies predominantly investigated the impact of both longer-term and brief-contact relaxation interventions on running economy, a measure defined as the rate of oxygen consumed during submaximal running velocities (Caird et al., 1999; Conley & Krahenbuhl, 1980; Hatfield et al., 1992; Moore, 2016; Smith et al., 1995). Given the focus of the present paper, however, we will only consider those studies that included a relevant outcome (e.g., perception of effort or endurance performance).

Brick et al. (2018) noted moderate reductions in perception of effort and activation (felt arousal) following brief-contact interventions instructing participants either to smile or to use cues to consciously relax their hands and upper-body whilst running in comparison with instructions to frown. These findings suggest that brief-contact relaxation interventions may be efficacious to alter perceptual responses during endurance tasks. Other studies have incorporated brief-contact relaxation techniques (e.g., PMR, centering, and/or directions to monitor breathing and muscular tension during performance) as part of multi-modal intervention packages that also included goal setting and motivational self-talk during running (Barwood et al., 2008; Patrick & Hrycaiko, 1998), swimming (Sheard & Goldby, 2006) and simulated triathlon tasks (Thelwell & Greenlees, 2001, 2003). Although these studies typically demonstrate an improved performance post-intervention, Thelwell and Greenlees (2003) provided an insight into the impact of relaxation strategies on performance. Specifically, post-task interviews revealed that participants employed breathing strategies pre-event to optimise arousal levels. Optimal arousal can, in turn, assist pace-regulation and help athletes avoid going too fast at the beginning of an event (Lane, Devonport, Friesen, et al., 2016). During the triathlon task, participants used breathing strategies to enhance their focus on process goals and race strategy, to reduce tension, and to reduce their focus on perceptions of pain and effort. Despite this, Barwood et al. (2008) noted that participants in their study rated arousal regulation strategies (i.e., PMR, centering) as the least useful and mental imagery and motivational self-talk as the most useful strategies to optimise running performance in hot conditions.

Collectively, these findings indicate that relaxation strategies during an event may help endurance participants cope with momentary thoughts to slow down or stop by helping to regulate their pace and reduce a focus on effort-related sensory cues and perceptions of effort (Brick et al., 2016; Thelwell & Greenlees, 2003). Finally, with regard to conditional knowledge (i.e., when to use a specific strategy), other relaxation strategies (e.g., brief PMR, centering) may help to optimise an individual's arousal level pre-event and enhance their focus on race strategy. In doing so, pre-event relaxation strategies can reduce the occurrence of tactical errors such as beginning an event at an excessively fast, unsustainable pace (Stanley et al., 2012; Thelwell & Greenlees, 2003), and the consequent experience of unhelpful thoughts about slowing or stopping.

Distractive Strategies

Active distraction strategies (e.g., focusing on attention-demanding puzzles, conversing) are typically associated with a reduction in effort perception in comparison with a focus on internal bodily sensations (Connolly & Janelle, 2003; Johnson & Siegel, 1992; Stanley et al., 2007, for a review see Brick et al., 2014). In addition to lower perceptions of effort, involuntary distraction (e.g., irrelevant daydreams, environmental scenery) is also associated with increased positive affective states during endurance activities, such as greater enjoyment and elevated mood (Aspinall et al., 2015; LaCaille et al., 2004). The extant literature also suggests that distractive strategies (active or involuntary) are particularly helpful for beginner participants, many of whom may not have acquired the procedural knowledge of active self-regulatory strategies to cope with the demands of endurance activity (Brick et al., 2020; Nietfeld, 2003). Furthermore, active distraction is also a useful strategy for endurance participants during longer-distance, lower-intensity activities (e.g., longer training runs or ultra-distance races) when thoughts about stopping may be precipitated by boredom, for example (Brick et al., 2015; Mooneyham & Schooler, 2013). Whether distractive strategies can help endurance participants cope with thoughts about stopping during higher-intensity endurance activities is questionable, however. Specifically, during higher intensity activity or when sensations of bodily discomfort are elevated over a prolonged duration, evidence suggests that distractive cognitions may be less effective than active self-regulatory strategies (Couture et al., 1999; Ekkekakis, 2009; Lind et al., 2009; Tenenbaum et al., 2008). As such, other psychological strategies presented in this overview, such as motivational self-talk, may be more effective than distraction to overcome thoughts about slowing or stopping during higher-intensity endurance activity.

Pacing, Judgement and Decision-Making

The impact of tactical variations in speed on endurance performance has attracted much research interest over the past several decades (de Koning et al., 1999; Hettinga et al., 2019). This idea, colloquially referred to as athletic pacing, has been defined as the control or distribution of power output, work, or energy expenditure, often to complete an event in the fastest possible time, having utilised all available resources (de Koning et al., 1999; Foster et al., 2003). Evidence for pacing as an effective strategy is mostly derived from observations of how successful athletes pace themselves in tasks of varying durations (Abbiss & Laursen, 2008; de Koning et al., 2011). Whereas an all-out pacing strategy works with short tasks of less than a minute (de Koning et al., 2011), a pacing strategy that conserves energy is more effective for endurance tasks (Abbiss & Laursen, 2008; St Clair Gibson et al., 2006). As such, if the pace is conservative, then an athlete is less likely to hold perceptions of exertion near to maximum, and, in turn, more likely to avoid experiencing thoughts about stopping in the first place (Brick et al., 2020; Deaner et al., 2015). A negative strategy, involving a slow start and gradually increasing speed, is the most conservative and least risky approach to pacing an endurance event, but probably does not produce the best performance (Thompson et al., 2003). In contrast, using fast-start strategies can deplete metabolic reserves too early (Thompson et al., 2003), are rarely successful (Abbiss & Laursen, 2008; de Koning et al., 2011) and indicate either a lack of experience or poor anticipatory mechanisms (Micklewright et al., 2012). A mixed, parabolic shaped strategy, incorporating a moderate starting speed, slower mid-section and fast finish, often results in faster completion of endurance events (Abbiss & Laursen, 2008) but requires individuals to make risk-based judgements about tolerable starting speed without compromising overall performance (Micklewright et al., 2015).

Physiological factors known to influence pace include core temperature, muscle acidosis, oxygen uptake, and carbohydrate availability (Tucker & Noakes, 2009). Environmental influences on pace include, but are not limited to, ambient temperature

(Tatterson et al., 2000), wind speed (Atkinson & Brunskill, 2000), and terrain (Micklewright et al., 2009). Most pertinent to this overview is the importance of various psychological and social factors that have been associated with pacing behaviours, such as perception of effort (Hampson et al., 2001; Marcora, 2009; Venhorst et al., 2018), previous experience (Micklewright et al., 2010), decision-making (Micklewright et al., 2017; Renfree et al., 2014), visual perception (Parry et al., 2013), information uptake and utilisation (Boya et al., 2017), emotion (Baron et al., 2011; Lane & Wilson, 2011), risk-taking personality traits (Micklewright et al., 2015), and competitor behaviour (Corbett et al., 2012). Such factors provide some evidential basis for brief-contact educational interventions that could help endurance participants of varying abilities develop effective pacing strategies according to the goals they have set themselves to help manage thoughts of slowing down or stopping.

Based on optimal pacing strategies and factors known to influence pacing in endurance activities, several recommendations for brief-contact interventions can be made to minimise behavioural urges to slow or stop. The focus of these pacing strategies can be split into activities before, during, and immediately after an event, which aligns with the self-regulation phases of planning (i.e., forethought), executing a plan (i.e., action), and reflecting on the effectiveness of the plan (Zimmerman, 2000). These skills have been highlighted as particularly important to develop pacing abilities in endurance contexts (Brick et al., 2016; Elferink-Gemser & Hettings, 2017).

Before an event, it might be advantageous to develop knowledge about the course, weather conditions, and, if relevant, likely competitors. A good understanding of the course profile will help develop a pacing strategy appropriate to the demands of the event (Brick et al., 2019) and inform (process) goals for the event. Similarly, the challenges of pacing against other competitors (Corbett et al., 2012) might be diminished with background research about their relative strengths, weaknesses, and past race strategies. During the event, subject to thorough pre-race preparation, individuals should be able to approximate a pacing strategy that best suits their objectives. Monitoring, evaluating, and adapting pacing is important to prevent errors that increase the risk of significantly slowing down or stopping later on in the event (Brick et al., 2016; Elferink-Gemser & Hettings, 2017). As such, tactical errors can be prevented through accurate pace monitoring of speed, time, and distance using GPS devices or learning particular landmark cues associated with a course. Furthermore, periodic monitoring of internal sensory cues (e.g., breathing rate) to inform pace-related decision-making may be a useful strategy to avoid pacing mistakes and subsequent thoughts about slowing or stopping (Brick et al., 2015; Brick et al., 2020). As soon after the event as possible, individuals may wish to mentally re-enact the race perhaps using the course profile or their GPS output data as a prompt. This is an important way to evaluate pacing, reflect, and update planning for future endurance events (Brick et al., 2016; Elferink-Gemser & Hettings, 2017). Mental re-enactment could include recalling which sections went well and which did not go so well, remembering feelings that were experienced at the time, and what pacing responses, psychological techniques (e.g., self-talk, relaxation) or behavioural actions were used to cope with unhelpful and unwanted thoughts during performance (Baker et al., 2005). To complete the self-regulation cycle, these reflections can inform planning (i.e., forethought) ahead of future endurance activities. More so, an approach to help individuals effectively engage in self-regulation, especially in the action phase and during critical performance moments is the formation of implementation intentions during the forethought phase (Sheeran & Webb, 2016). Implementation intentions, as applied to overcome thoughts about slowing down or stopping, are considered in the following section.

Implementation Intentions

In this section, we propose a novel use for implementation intentions (i.e., if-then planning) to develop endurance participants' conditional knowledge of when to use specific strategies. Individuals often set goals and engage in strategic planning in the forethought phase of self-regulation. These intentions are, however, not always acted on; that is, they do not automatically convert to behaviour (Heckhausen & Gollwitzer, 1987; Webb et al., 2012). To help reduce the gap between goal intentions (e.g., "I want to keep going at a steady pace") and subsequent actions, individuals can employ implementation intentions, or if-then planning (Gollwitzer, 1999). Specifically, an individual experiencing thoughts of slowing or stopping can reflect on and appraise their situation to identify which psychological strategies are likely to be most effective in regulating their response and maintaining goal pursuit to keep going (the 'then'). As such, implementation intentions support the realisation of goal intentions by specifying when, where, and how goal-directed responses should be initiated. Implementation intentions typically take the form of an explicit plan expressed as, "*If* situation X arises, *then* I will do Y" (Gollwitzer, 1999; Lane, Devonport, Stanley, et al., 2016; Lane, Totterdell, et al., 2016). If-then plans represent a simple, evidence-based technique to help people act on goal intentions and initiate facilitative actions at the critical juncture to realise goal achievement. The effectiveness of if-then planning lies in the applicability and accessibility of strategic responses during critical performance moments (Gollwitzer, 1999; Lane, Totterdell, et al., 2016).

Although widely researched in health behaviour settings, implementation intentions have not, to date, been extensively applied in the whole-body endurance performance literature (Hirsch et al., 2020; Lane, Devonport, Stanley, et al., 2016; Lane, Totterdell, et al., 2016). We propose that implementation intentions might provide a novel, action-oriented method to enhance the effectiveness of brief-contact psychological strategy interventions in endurance performance contexts. In support, implementation intentions have, for example, been shown to enhance goal attainment and self-regulation of disruptive thoughts and physiological states in other sporting settings such as tennis (Achtziger et al., 2008). Applied to endurance performance contexts, implementation intentions may, for example, be used to adhere to a pre-planned pacing strategy (then) to avoid going too fast at the start of a marathon (if), a common error made by less experienced participants (Deaner et al., 2015). Similarly, a cyclist might plan to use a motivational self-statement (then) if their perception of effort is elevated and their self-talk becomes negative and defeatist (i.e., a psychological crisis; Schüler & Langens, 2007). Recognising situations that can trigger an unhelpful behavioural or emotional response may help endurance athletes self-regulate more effectively using antecedent-focused strategies (McCormick et al., 2018b). Using implementation intentions in this way aligns with the different phases of self-regulation (i.e., forethought, action, and reflection). Specifically, becoming aware of critical situations where thoughts of slowing down or stopping occur (i.e., action and reflection) can help to plan for future situations (i.e., forethought).

Despite these positive assertions, the use of implementation intentions does come with some important caveats that practitioners and coaches should consider. Foremost amongst these is a careful contemplation of the planned-for scenarios. Specifically, practicing implementation-intentions for situations that are unrealistic or unlikely to occur (i.e., the *if* part) will not be of benefit to the athlete (Brandstätter et al., 2001; Gollwitzer & Oettingen, 2011). Similarly, one should also be cautious about focusing too much on expecting a critical situation to happen (Hirsch et al., 2020). This can potentially place excessive focus on the critical situation and not on more relevant, task-specific processes. In addition, the response to a situation (i.e., the *then* part) needs to be appropriate and should also be carefully considered when planning pre-event (Brandstätter et al., 2001; Gollwitzer & Oettingen, 2011). Specifically, when employing implementation intentions as the basis of a brief-contact intervention, it is essential to encourage the athlete to practice and reflect on the use of a formulated response to update future if-then plans. Furthermore, when considering using psychological strategies as an intervention, it is important to explore the athlete's expectations of success and their goal intention. To illustrate, when an individual expects to be successful, they may have a strong commitment to a strategy or an if-then plan. In contrast, when the expectations of success are low an individual may not commit to a formulated if-then plan (Oettingen & Gollwitzer, 2010).

Critique of the Evidence Base

As highlighted throughout this expert opinion paper, the available research evidence demonstrates that a range of psychological strategies can be used to overcome slowing down or stopping. To further support this contention, we have included a table in Appendix 1 to provide a descriptive overview of each of the intervention studies comprising the evidence-base for the strategies presented in this paper. Whereas the Working Group selected five psychological strategies that are grounded in research evidence, as Appendix 1 highlights, the five strategies vary in the amount of experimental research that supports their efficacy as brief interventions for improving endurance performance. Notably, pacing, judgement, and decision-making is a highly researched topic in endurance contexts, but there is a lack of intervention studies aiming to improve pacing to benefit outcomes such as performance and quality of experience. Brief-contact educational interventions to improve pacing, judgement, and decision-making (e.g., advice on pacing strategies for participants completing their first mass-participation event) could be valuable. Although the experimental evidence for each strategy varies, there are consistent limitations across the research area that could be considered when interpreting the research evidence.

Specifically, researchers aim to determine if interventions are efficacious, and often approach this using randomised, controlled experiments in laboratory environments. Such efficacy studies occur in different conditions to where athletes perform, however, and, as such, the generalisability of this work to applied settings is unclear from the perspectives of athletes and practitioners. These issues are not unique to sport psychology research and practice and are also prevalent concerns in the broader sport and exercise science domain (Beedie et al., 2015). Few studies have been conducted at actual endurance events with endurance athletes as participants (for exceptions, see Jaenes et al., 2021; McCormick et al., 2018a; Schüler & Langens, 2007). This is an important limitation given that the stressors experienced at real-life events, and how these stressors are appraised, may differ from those typically experienced in laboratory-based research (McCormick et al., 2020). Consequently, event stressors and other antecedents of thoughts about slowing down or stopping may not be fully explicated in the extant literature (Meijen et al., 2018).

In addition, few studies have delivered ecologically valid psychological interventions in endurance settings. This applies to brief-contact interventions, as well as to more personalised and longer-term, ongoing psychological interventions. In relation to this overview, although studies have examined the effects of brief-contact instructions and workbooks, there is a lack of studies examining the effects of interventions delivered as webpages, online videos, workshops, magazine articles, podcasts, or similar (as an exception, see Meijen et al., 2021). We encourage more research that examines the effects of interventions that are delivered in ways that reflect applied sport psychology, for real-life endurance participants. Similarly, we also advocate for studies that consider the broader environment of the endurance athlete, whereby sport psychology practitioners educate coaches, sport scientists, sport therapists, and other professionals on evidence-based, brief-contact intervention strategies that these individuals may, in turn, use with endurance athletes.

Although these points could be addressed using efficacy studies, effectiveness studies are also encouraged (Bishop, 2008) to help determine the effects of interventions when delivered to the target population, within a real-life sport context, and when measuring real-life endurance variables (e.g., performance time at an event or percentage of an event walked). The interventions could be delivered in ways that are preferable to endurance participants or that draw on facilitators to intervention use (e.g., interventions delivered through popular endurance websites; McCormick et al., 2020), and they would need to overcome constraints of the real-life sporting world (e.g., time constraints, coach knowledge constraints; Bishop, 2008). In contrast to the short-term effects typically documented in research, studies could also consider the long-term impact of interventions, such as the effects on performance over the course of months or a competitive season. Attempts to conduct longer-term, ecologically valid research that has sufficient control remains an extremely challenging task for the academic community, yet is not unprecedented in the wider sport psychology literature (e.g., Senécal et al., 2008). The size of the challenge should not be under-estimated.

Furthermore, as discussed elsewhere (McCormick et al., 2015; McCormick et al., 2019), relatively few intervention studies in the endurance context are theoretically informed. Few have designed interventions, such as brief-contact educational interventions, to target the underpinning intervention-performance mechanisms. Some interventions have been informed by the psychobiological model of endurance performance, and have aimed to reduce perception of effort (Blanchfield et al., 2014). Nevertheless, other psychological constructs such as self-efficacy (Anstiss et al., 2018), self-control and motivation (Taylor et al., 2018), pain (Mauger, 2019), and emotion (McCormick et al., 2015) are relevant to endurance performance. Theoretically informed interventions could target mechanisms underpinning endurance performance, and therefore lead to greater or more consistent intervention effects (McCormick et al., 2015; McCormick et al., 2019). A range of theoretical approaches and frameworks have been suggested to better inform intervention studies in the endurance context (e.g., Brick et al., 2015; McCormick et al., 2019; Micklewright et al., 2017; Renfree et al., 2014; Taylor et al., 2018).

Finally, only a select number of intervention studies included in this overview have taken an interdisciplinary approach (e.g., Barwood et al., 2008; Blanchfield et al., 2014; Smith et al., 1995). For example, Barwood and colleagues (2008) tested the effect of a psychological skills training intervention consisting of goal setting, relaxation, mental imagery, and positive/motivational self-talk on a 90-minute running task in hot

(30°C) conditions. Outcome measures included physiological (e.g., body temperature, sweat production, hormone production) and psychophysiological variables (e.g., ratings of perceived effort, thermal comfort). The findings revealed that participants who received the psychological skills training maintained a faster pace and ran significantly further (8%) post-intervention in comparison with pre-intervention, though physiological measures did not indicate a mechanism underpinning this improvement. Despite the potential challenges of designing interdisciplinary research, we suggest that researchers work using an interdisciplinary approach (e.g., by including physiologists, biomechanists, and psychologists in a research team) as the psychological, biomechanical, and physiological elements of endurance performance interact. This proposition is reinforced by Moore and colleagues (Moore et al., 2019), who recently demonstrated how verbal cues focused either internally (i.e., "run with a flat foot"), externally (i.e., "run quietly"), or combined based on clinical practice (i.e., "we are aiming to change foot strike, so run quietly") impacted differentially on running kinematics, physiological (e.g., volume of oxygen consumed) and psychophysiological (e.g., rating of perceived effort) responses during six-minute running trials. As such, adopting an interdisciplinary approach will help ensure that the impact of brief educational psychological interventions during endurance activity are fully explored, that best-practice advice considers all aspects of performance, and that risks associated with attempting to overcome thoughts about slowing down or stopping are taken into account. These risks are discussed next.

Risks Associated with Attempting to Overcome Thoughts about Slowing Down or Stopping

The psychological strategies described in this expert opinion paper may appear to have no side effects. However, it is not always advisable to attempt to overcome thoughts of slowing or stopping, particularly in conditions (e.g. heat exhaustion) that can lead to life-threatening events (e.g., heat stroke) and when continued endurance exercise can aggravate a musculoskeletal injury. In most circumstances, using psychological strategies to overcome thoughts about slowing down or stopping is safe as demonstrated by numerous controlled, experimental studies on the effects of psychological interventions on endurance performance in healthy adults (McCormick et al., 2015). There are, however, real-life situations in which overcoming these behavioural impulses may harm the endurance participant or even lead to their death. In line with the earlier discussion on conditional knowledge, here we provide a brief overview of such situations to help the endurance participant recognise them, and provide references for further reading. When in doubt, help should always be sought from the race medical personnel.

The first condition that can be aggravated by continued endurance exercise is musculoskeletal injury. The sharp and usually localised pain associated with it should not be ignored. On the contrary, it is safe to continue exercising when experiencing the naturally occurring muscle pain caused by lactic acid and other by-products of high-intensity endurance exercise (e.g., whilst cycling a steep hill; Cook et al., 1997; Pollak et al., 2014). Another kind of pain common in endurance exercise with eccentric muscle contractions and/or multiple days of competitions (e.g., ultra-trails) is acute or delayed-onset muscle soreness. Although muscle soreness is normally associated with damage of the muscle fibres, it is still possible to perform endurance exercise safely (Marcora & Bosio, 2007). However, if the endurance participant experiences very severe muscle soreness and/or the urine is of a dark red or brown colour, they should stop and immediately seek medical attention because these are signs and symptoms of acute exertional rhabdomyolysis. If left untreated, this condition can lead to kidney failure and, in some cases, death (Brudvig & Fitzgerald, 2007).

Another situation that it is not advisable to resist stopping during is when experiencing symptoms of myocardial ischaemia or other acute cardiovascular events that can occur during endurance competitions (Gerardin et al., 2016). Whereas a high heart rate and heavy breathing are normal responses to intense exercise, angina, irregular heartbeats, and severe shortness of breath are not (Hamilton et al., 1995). Although a rare occurrence in running, these symptoms can be associated with more severe events such as sudden cardiac death (e.g., Day & Thompson, 2010). Instead of overcoming these symptoms of an acute cardiovascular event, endurance participants should stop and request immediate medical assistance to prevent further complications and risk (Gerardin et al., 2016).

The last condition that endurance participants should learn to prevent is heat stroke. This condition, defined as a core temperature of >40°C with central nervous system disturbances (e.g., ataxia and confusion), is associated with significant morbidity and mortality and occurs relatively often in individuals competing in hot and humid environments (Howe & Boden, 2007). Although the use of psychological strategies like motivational self-talk during endurance exercise in the heat have seemed safe in controlled experimental studies (Hatzigeorgiadis et al., 2018; Wallace et al., 2017), there is no doubt that prolonging endurance exercise in people at risk of developing heat stroke may be dangerous (Westwood et al., 2021). The challenge for the endurance performer is to recognise the symptoms of heat exhaustion and stop exercising before it progresses to heat stroke, or plan for challenging environmental conditions to prevent heat exhaustion from occurring. The symptoms of heat exhaustion are dizziness, malaise, nausea/vomiting, headache, and extreme fatigue (Howe & Boden, 2007).

Conclusion

Research supports the use of a range of psychological strategies to resist slowing down or stopping during endurance activity. We have provided an expert opinion on how brief-contact, educational interventions that draw on research on goal setting, motivational self-talk, relaxation, distraction, and pacing can be used to resist these behavioural urges. We have also proposed that implementation intentions (i.e., if-then plans) offer a structure for using these strategies that fit the endurance context and that can develop individuals' conditional knowledge of when to use specific strategies. We suggest that the content of brief-contact educational interventions could be shared with large populations of endurance athletes, particularly recreational participants, face-to-face by accredited and trainee sport and exercise psychologists and by appropriately trained coaches, sport scientists, and sport therapists. Intervention content can also be shared via alternative media including websites, online videos, workshops, or in magazine articles. Finally, to promote further research in this domain, ecologically-valid efficacy and effectiveness studies are encouraged that examine the effects of psychological strategies on both acute and longer-term outcomes.

Compliance with Ethical Standards

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Psychological Strategies to Resist Slowing Down or Stopping during Endurance Activity: An Expert Opinion Paper

Appendix 1

Appendix 1. Descriptive overview of intervention studies relating to resisting slowing down or stopping

Intervention	Study	Participant information	Design overview	Endurance task	Intervention information	Outcome relating to resisting slowing down or stopping
Goal setting	Tenenbaum et al. (1999)	28 female, secondary-school, cross-country runners (age = 14.6 ± 1.2).	Pretest-posttest design with three experimental groups and no control. Ps were assigned by block randomisation.	Running 2.3 km run on a road course.	Assignment of an easy, challenging, or unrealistic combination of short-term and long-term goals (5%, 10%, or 15% improvement in four weeks, with weekly targets). Goals were private and assigned verbally on an individual basis.	Each group's best post-intervention performance was significantly faster than baseline (M = 7.8%). Improvements did not significantly differ between groups.
	Theodorakis et al. (1998)	40 university students (f = 23, m = 17, age = 20.3 ± 2.1).	Pretest-posttest design with a control group.	Cycling Incremental test on an ergometer.	Goal setting and performance feedback. Ps set a specific goal (orally and in writing) for improved performance. Elapsed time was displayed during performance.	The goal setting group showed a significantly greater increase in endurance performance (M = 12.3% / 110.4 s) compared to the control (M = 1.9%).
Motivational self-talk	Blanchfield et al. (2014)	24 recreationally trained individuals (f = 9, m = 15, age = 24.6 ± 7.5).	Pretest-posttest design with a randomised control group. .	Cycling Time-to-exhaustion test on an ergometer.	Two-stage self-talk intervention delivered over two weeks using a workbook. Stage 1 = Introduction to self-talk and selection of four motivational self-talk statements. Stage 2 = Using self-talk during three or more exercise sessions.	Time to exhaustion significantly increased in the self-talk group (M = 17.9% / 114 s), but not in the control (-2.5%).

Motivational self-talk (continued)	Wallace et al. (2017)	18 trained cyclists (m = 14, f = 4, age range = 18-50).	Pretest-posttest design with a randomised control group.	Cycling Time-to-exhaustion test on an ergometer in hot conditions.	Two-stage self-talk intervention delivered over two weeks using a workbook. Stage 1 = Introduction to self-talk, identification of their own negative self-talk, and selection of five motivational self-talk statements. Stage 2 = Using self-talk during three training sessions, over two weeks.	Self-talk significantly increased time-to-exhaustion by 39.4% (from 487 to 679 s). There was not a significant difference for the control group (from 531 to 510 s).
	Barwood et al. (2015)	14 recreationally-active males (age = 19 ± 1).	Pretest-posttest design with a control group. Ps were matched before assignment.	Cycling 10 km time trial on an ergometer.	One-hour classroom session with a structured workbook. Ps identified their negative self-talk statements and chose motivational statements to counter these with during each 2 km section. Ps rehearsed statements during the days and moments preceding each time trial.	Motivational self-talk significantly improved time-trial performance (M = 3.75%). Neutral self-talk did not (M = -1.30%).
	Hatzigeorgisdis et al. (2018)	16 male sport science students (age = 22.5 ± 4.9).	Randomised, controlled, posttest-only experimental design.	Cycling 30 min constant duration test in hot conditions at a steady RPE.	Ps received a brief introduction on the use of self-talk strategies. Then they chose cues from a list of motivational cues typically used to boost motivation and effort, or they devised their own. Ps were asked to use self-talk every two minutes during the test.	Ps in the self-talk group produced significantly greater power output during the final third of the trial, compared to the control.

Motivational self-talk (continued)	McCormick et al. (2018)	29 ultramarathon runners (m = 25, f = 4, age = 39.3 ± 8.4).	Randomised, controlled, posttest-only experimental design.	Running Self-supported, overnight, 60-mile ultramarathon.	Workbooks introduced self-talk, asked Ps to notice their self-talk and its impact, and choose four new statements to use during the ultramarathon. Ps practiced self-talk in training runs for approximately two weeks.	The difference in performance times was not statistically significant. The mean performance time of the self-talk group (824 minutes, SD = 97) was 12 minutes (1.44%) faster than the control group.
	de Matos et al. (2021)	21 recreational triathletes (m = 15, f = 6, age M = 32.7, age range = 21-47).	Pretest-posttest design with randomisation to one of two intervention groups.	Swimming 750 m swim in a 50 m pool.	The motivational group used four motivational sentences to improve effort, confidence, and psyching up. The instructional group used four sentences to improve focus, technique, and pace. A practitioner made the sentences based on reported dysfunctional thoughts, and distributed via printed guides and WhatsApp. Ps had 12 days to rehearse in training. Ps used sentences after dysfunctional thoughts.	Motivational self-talk led to a significant 2.8% improvement in 750 m swimming performance (from 821 to 797 s). Instructional self-talk did not lead to a statistically-significant effect (0.39% improvement, 799 to 796 s).
	Hardy et al. (2019)	16 recreationally active males (age = 22.0 ± 3.0).	Randomised, repeated-measures design.	Cycling 10 km time trial on an ergometer.	A workbook was used to raise Ps' awareness of their self-talk, and to change negative self-talk into motivational and positive self-talk. Ps used self-talk for each 2km stage and	Ps performed 2.2% faster (M = 1045 s) when in the second-person condition, compared to the first-person

					to counter negative self-talk. Self-talk was either in first person (e.g., "*I* can tolerate this") or second person (e.g., "*You* can tolerate this").	self-talk condition (M = 1068 s).
Motivational self-talk (continued)	Schüler and Langens (2007)	110 non-professional marathon runners (m=91, f=19).	Randomised, controlled, posttest-only experimental design.	Running A real-life marathon.	Ps chose a self-verbalisation to use during the marathon, which was either their own or from a list that related to self-encouragement, anticipation of positive outcomes, and self-calming.	Ps who had a large 'psychological crisis' achieved significantly faster running times when they used self-verbalizations than when they did not use them. There was no difference for Ps who had a small 'crisis'.
	DeWolfe et al. (2021)	93 university students (m =53, f = 40, age 20.4 ± 2.4)	Between groups design with random assignment (with matching) to three experimental conditions and a neutral control.	Cycling 20-minute 'do your best' constant duration test.	Before the cycling task, Ps created ST statements with the researcher for their assigned condition. Self-talk was motivational (e.g., "Keep it up"), neutral (e.g., "The bike is red"), negative/discouraging (e.g., "My legs are tired"), or challenging (the same type of discouraging words as the negative group, but with a statement to embrace negative self-talk as a challenge, e.g., "My legs are tired, but I can push through it").	The challenging self-talk group (M = 2.0 km; SD = 0.3) covered significantly greater distance than the negative ST group (M = 1.8 km; SD = 0.3) in time block four. No other significant differences were present between groups at the various time points.
Relaxation	Hatfield et al. (1992)	12 male intercollegiate cross-country	Counterbalanced repeated-measures design with two experimental	Running 3 x 12 min blocks of treadmill	Biofeedback: Ps were provided with ventilation and EMG biofeedback.	RPE was lower in the biofeedback (12.5 ± 0.5) and distraction (12.5 ± 0.7)

		runners (age = 22.2 ± 1.3).	conditions and a no-instruction control.	running just below ventilatory threshold.	Distraction: Ps were required to press a button on a hand-held device, timing the button press to coincide with the illumination of the final light in a series. Trials presented every 4s.	conditions than control (13.04 ± 0.6).
Relaxation (continued)	Brick et al. (2018)	24 club-level endurance runners (m = 13, f = 11, age 44.6 ± 10.8).	Randomised, repeated-measures design with three experimental conditions and a no-instruction control.	Running 4 x 6 min blocks on a treadmill at 70% of maximum oxygen uptake.	Brief instructions to focus on smiling, frowning, relaxing their hands and upper body, or no-instruction control.	RPE higher when frowning (12.29 ± 1.88), compared to smiling (11.25 ± 1.94) and relaxing (11.38 ± 1.76). No differences in RPE between any other pairs of conditions.
Distractive strategies	Johnson and Siegel (1992)	44 college females (age = 21.3 ± 4.9).	Between groups design with random assignment to three experimental conditions and a control.	Cycling 15 minutes cycling at 60% of predicted maximum oxygen uptake.	Instruction given immediately before task performance. Association: focus on physical symptoms. Internal dissociation: recall names. External dissociation: hold conversation. Control: No instruction	RPE was significantly higher for association (15.4) than internal dissociation (12.0). No difference in RPE between internal dissociation, external dissociation, and control.
	Stanley et al. (2007)	13 female exercisers (age = 20.1 ± 1.75).	Repeated-measures design with four sequential	Cycling 10 min bout at 75%	Internal association: Asked to focus on their form, breathing, perspiration, and how their muscles felt.	RPE was higher in internal (13.74 ± 1.25, on 6-20 scale) and external (14.03 ± 1.01) associative conditions than

			experimental conditions.	maximum oxygen uptake.	Internal dissociation: Watched a self-selected video. External association: Asked to focus on the ergometer digital readings. External dissociation: Asked to pay attention to the gymnasium.	internal (12.95 ± 1.46) and external (12.95 ± 0.91) dissociative conditions. No difference between internal and external conditions.
Distractive strategies (continued)	Connolly and Janelle (2003) Study 1	8 female varsity rowers (age = 19.9 ± 1.31).	Counterbalanced, repeated-measures design.	Rowing. 20 min aerobic row at 'steady state' or '75% pressure'	Association: Instructed to focus on their breathing, body, and technique. Dissociation: Instructed to focus on collages.	Ps rowed 1.9% further when using association (4369.8m) than dissociation (4286.5m). No significant difference between RPE (12.5 and 12.2 respectively, on 6-20 scale).
	Connolly and Janelle (2003) Study 2	22 varsity collegiate rowers (m = 10, f = 12, m age = 19.6 ± 2.0, f age = 20.3 ± 2.0).	Counterbalanced, repeated-measures design.	Rowing. 2000 m anaerobic ergometer row at 160-180 heart rate.	Internal association: Instructed to focus on their breathing, technique, and body. External association: Instructed to strategize and race against others. Internal dissociation: Instructed to solve maths problems. External dissociation: Instructed to watch a video.	Ps rowed significantly faster in the internal and external association conditions compared to baseline and the internal dissociation condition. RPE was higher in the internal and external association conditions than baseline. There was no difference between the four attention conditions for RPE.

	LaCaille et al. (2004)	60 people who run (m = 22, f = 38, age = 26.8 ± 8.9).	A 3 x 2 x 2 mixed experimental design (exercise setting x cognitive strategy x gender)	Running 5km run	Exercise setting: treadmill, indoor track, and outdoor route. Cognitive strategies: Association or dissociation. Association involved monitoring their heart rate, and dissociation involved listening to music.	The association group ran faster (26.1 ± 4.39 minutes versus 27.9 ± 3.94 minutes). No overall differences in RPE between the cognitive strategies.
Multi-modal interventions	Barwood et al. (2008)	18 males (PST age = 23 ± 3, control age = 28 ± 5).	Pretest-posttest design with a control group. Ps were matched before random assignment.	Running 90 min treadmill constant duration test in hot conditions.	PST package to meet the demands of exercising in the heat. Four one-hour PST sessions were delivered in the four days preceding performance (goal setting, arousal regulation, mental imagery, and positive self-talk).	The PST group ran significantly farther (M = 8% / 1.15 km) after receiving the intervention. The control group ran similar distances in each trial.
	Patrick and Hrycaiko (1998)	3 triathletes of varying ability and 1 national-level runner (m = 4, age range = 25-37).	Single-subject, multiple-baseline design across participants.	Running 1.6 km run on a track.	PST package delivered on an individual basis over three days (relaxation, imagery, self-talk, and goal setting). Skills were presented in a self-teaching workbook that contained reading and exercises. The first two sessions lasted 90 minutes, and a third session was dedicated to answering questions.	All Ps improved their performance following the intervention.

	Sheard and Golby (2006)	36 national-level swimmers (f = 23, m = 13, age = 13.9 ± 2.0, age range = 10-18).	Pretest-posttest design without a control group. Ps' best competitive performance times were obtained pre-, post-, and one-month post-intervention.	Swimming Competition performances for different strokes and distances.	PST program. Five weekly sessions were conducted on a one-to-one basis (goal setting, visualisation, relaxation, concentration, and thought stopping). Each session was personalised and lasted 45 minutes.	Performance time was significantly faster in one out of five endurance events post-intervention. Performance times were significantly faster in two endurance events one-month post-intervention.
Multi-modal interventions (continued)	Thelwell and Greenlees (2001)	5 male members of a gymnasium (age = 24.2 ± 4.6).	Single-subject, multiple-baseline design across participants.	Gymnasium triathlon 2 km row, 5 km cycle, 3 km run.	PST package delivered on a one-to-one basis over four consecutive days (goal setting, relaxation, imagery, and self-talk). Each session lasted up to one hour and included education, workbook exercises, and homework.	All Ps improved their performance (M = 32.6 s improvement) following the intervention.
	Thelwell and Greenlees (2003)	4 male members of a gymnasium (age range = 19-21).	Single-subject, multiple-baseline design across participants.	Gymnasium triathlon 2 km row, 5 km cycle, 3 km run.	See Thelwell and Greenlees (2001).	All Ps improved their performance (M = 7.5% / 81 s) following the intervention.
If-then planning	Lane et al. (2016)	147 distance runners (m = 53, f = 94, age = 40.5 ± 9.1).	Randomised, controlled, pretest-posttest design with	Running Self-chosen run, while	Ps made two personalized if-then plans, with an emotion regulation goal. They had two weeks to use their strategies in training.	Neither intervention had a significant effect on performance.

	two experimental groups and a control.	pursuing a goal.	A second group set emotion-focused goals.

f number of female participants, *m* number of male participants, *M* mean, *P(s)* participant(s), *PST* psychological skills training, *RPE* rating of perceived effort, ± mean ± standard deviation. Note: Table most recently updated June 2021. The studies included in this table represent the evidence-base of intervention studies cited within the manuscript with an outcome relevant to slowing down or stopping, such as performance during self-paced time trials, exercise time to exhaustion, or perception of effort during fixed-pace tasks.