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Sport performance interventions: Evaluating past strategies and providing future recommendations

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The purpose of this review is to highlight the emergence and development of psychological interventions that facilitate optimal performance, and propose future directions for applied sport interventions. Within the past 40 years, educational and alternative psychological skills training (PST) strategies (e.g., self-talk, relaxation) have been proposed, and researchers have shown they can be effective in facilitating athletic performance. However, such PST interventions largely promote the removal (or reduction) of unwanted psychological experiences. In contrast, researchers have offered contemporary approaches whereby athletes should be encouraged to increase their capacity to experience unwanted feelings, cognitions, or intentions, rather eliminating them, to increase psychological flexibility for optimal performance. We review this literature and offer future research directions that focus on the use of technology, on-line sport psychology consultancy, and consideration of post-performance assessments, as methods to improve future PST intervention delivery.

KEY WORDS: Applied Sport Psychology, Athlete, Mental Skills, Narrative Review, Optimal Performance, Psychological Skill Training.

Fifty years has passed since the "birth" of the *International Journal of Sport Psychology*, providing a good opportunity to reflect on the applied sport psychology research journey to date, the scientific knowledge gained, and possible future research directions regarding sport performance interventions. Psychological-based performance interventions for sport performers began within general psychology programs designed to lower the stress response and specifically, anxiety. It was soon recognized, however, that the

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emotional response of athletes performing under pressure was far more complex, and there was a need for developing and applying psychological interventions (or mental skills programs) that reflected such complexity in order to achieve optimal athletic performance.

The purpose of this manuscript is to review the emergence and development of psychological interventions for athletes, and propose future directions for applied interventions, which offer the potential to enhance sporting performance. This review will focus predominantly on interventions published within the past 40 years; it is during this time that research on performance-enhancing interventions has burgeoned.

Emergence and Development of Psychological Interventions Maximizing Peak Performance and Psychological Preparation for Competition

To perform at the highest level, athletes spend countless hours on technical and skill acquisition, strength and conditioning preparation, and tactical development. To achieve elite success, however, well-developed psychological skills usually separate the "best from the rest". Applied psychology researchers initially examined the differences between successful and less successful athletes to understand and promote an "ideal" psychological mindset, determine the mechanism through which this mindset can be achieved, and construct interventions to help athletes achieve an optimum psychological state more often. For example, Mahoney and Avener (1977) explored the psychological factors and cognitive strategies associated with optimal performance of 13 elite United States Olympic gymnasts and found that significant positive correlations existed between uses of internal imagery, frequency of gymnastics thoughts, self-talk, self-confidence, and the gymnasts' success. Later, Meyers, Cooke, Cullen, and Liles (1979) determined that "better" college racquetball players were more self-confident, exhibited more self-talk in training and competition, reported less self-doubts, and performed more successfully in dreams. Similarly, Mahoney, Gabriel, and Perkins (1987) ascertained that elite (compared to non-elite) athletes managed anxiety more effectively, had higher levels of concentration, self-confidence, and motivation, and used more kinesthetic imagery. Collectively, this early work indicated that successful athletes demonstrated certain psychological skills that differed from their less successful counterparts, with such observations evoking the question of whether those skills could be "trainable", and thereby enable practitioners to enhance their athletes' performance further.

Psychological Skills Training

Vealey (1988) defined psychological skills training (PST) as "techniques and strategies designed to teach or enhance mental skills that facilitate performance and a positive approach to sport competition" (p. 319). Hence, PST interventions aim to facilitate athletic optimal performance and scholars have established the effectiveness of these approaches (see Table 1 for brief descriptions of the most robust reviews available). In 1989, Greenspan and Feltz conducted the first meta-analysis on the effects of psychological intervention on sport performance and found that PST interventions positively influenced performance in over 80% of the studies they examined. Subsequently, Vealey (1994) reported that more than 75% of the included studies exhibited performance improvements in both individual and team sports. These results were also consistent with the findings within Weinberg and Comar's review (1994). Over a decade later, Martin, Vause, and Schwartzman (2005) re-analyzed the studies included within the Greenspan and Feltz meta-analysis, included contemporary literature in their review, and concluded that PST had a positive effect in 93% of the studies, with nine (60%) studies having a substantial positive performance effect. A limitation, however, was that there was limited information regarding the meaning of "substantial" effect, and it was not a meta-analysis. Most recently, Brown and Fletcher (2017) conducted a meta-analysis on intervention studies with high internal and external validity, and found that PST interventions were overall moderately effective in improving sport performance. Although there were shortcomings inherent in the reviews (e.g., publication bias), it remains the case that PST can facilitate athletic performance.

The aforementioned discussion focused on studies that illustrated the general effectiveness of PST interventions. As this research expanded, investigators evaluated the effectiveness of specific types of PST interventions (Table I). In the 1980s and 1990s, practitioners who provided PST interventions adopted an "educational" philosophy where psychological strategies (e.g., mental practice, self-talk, relaxation training) were used to educate athletes on how to better prepare for, and manage, competition. Beyond these traditional PST approaches, psychologists have also used alternative PST techniques (e.g., biofeedback) that have incorporated technology to help facilitate learning. We offer brief discussions of these approaches below, by presenting initial contributions to, reviews completed on, and recent studies involving, specific PST interventions on performance.

TABLE I
Systematic And Meta-Analytic Reviews On The Effects Of Psychological Interventions On Sport Performance

Study	Background Context	Key Findings
Mixed Intervention Reviews		
Greenspan & Feltz (1989)	This systematic review was the first attempt to synthesize literature on the effects of psychological interventions on athletes in competitive situations (i.e., sport performance). Interventions were defined as "actions initiated by someone other than the athlete that focused on psychological skills in an attempt to improve the athlete's performance during competition" (p. 221), and were classified into relaxation training, behavioral techniques, and cognitive restructuring.	23 educational, or remedial, interventions were identified with nine classified as relaxation-based, three as behavioral, and 11 as cognitive restructuring. Greenspan and Feltz (1989) concluded that educational relaxation-based, and remedial cognitive restructuring, interventions were largely effective.
Vealey (1994)	This systematic review further asserted the credibility of sport psychology. The review was designed to update knowledge from Greenspan and Feltz' (1989) by synthesizing the findings of sport psychology intervention studies published between 1988 and 1991.	12 interventions were identified with seven categorized as cognitive, three as cognitive-behavioral, and two as behavioral. Seven of the 12 interventions established causal performance enhancing effects.
Weinberg & Comar (1994)	Situated in the debates, the purpose of this systematic review was to establish the effectiveness of psychological interventions in competitive sports and was a follow-up to Vealey (1994). Similar inclusion criteria to the previous reviews were adopted, with included studies required to assess effectiveness via changes in athletic performance in actual competitive situations.	10 relevant studies published in 1992 and 1993 were identified. Of the interventions examined, four were categorized as cognitive and six as cognitive-behavioral according to the description from Vealey (1994). Six of the 10 interventions found causal performance enhancing effects.

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Study	Background Context	Key Findings
Mixed Intervention Reviews		
Martin et al. (2005)	Given the growth of sport psychology (e.g., journals, textbooks, conferences, and professional associations), this systematic review examined the effects of psychological interventions on the directly and reliably measured behavior of athletes in competition from published experimental studies.	15 studies met the inclusion criteria and used either a single-subject, or groups experimental, design. Martin et al. (2005) explained that 14 of the 15 interventions had a positive effect on sport performance.
Brown & Fletcher (2017)	The purpose of this systematic, and meta-analytic, review was to synthesize the most rigorous research evaluating the effects of psychological, social, or psychosocial interventions with sport performers on variables related to their athletic performance. Psychological, social, or psychosocial interventions were "any actions or processes that alter functioning and/or performance through changes in an individual's thought and behavior, through social factors, or through a combination of both individual thought and behavior and social factors, respectively" (p. 78)	35 studies met the inclusion criteria, which included the delivery of 58 interventions. Of these, 46 were classified as psychological, and 12 as psychosocial (e.g., motivational video footage), interventions. Results indicated that psychological and psychosocial interventions had a moderate, positive effect on sport performance, but that this effect had a lack of precision (i.e., varied widely). Psychosocial interventions produced the largest effects. A follow-up analysis showed that interventions had an overall large positive effect on sport performance at least a month after the intervention had finished. Positive performance effects for PST interventions were also greater for males than females.
Mixed Intervention Reviews Involving Stress or Pressure		
Rumbold et al. (2012)	With increasing awareness for athletes to manage a wide range of environmental demands to prevent impairments to performance and health, this systematic review sought to "systematically identify and evaluate the psychosocial interventions used to manage a component of the stress process in competitive sport performers" (p. 175).	63 papers met the inclusion criteria with interventions classified as cognitive (n = 11), multimodal (n= 44), and alternative interventions (n = 9). Of the 39 studies, 22 provided evidence for a combined positive effect on stress and performance and, when considering performance alone, 30 studies reported positive effects. Only 13 of 23 studies showed positive outcomes for both stress and performance when considering studies with the highest efficacy. Thus, Rumbold et al. (2012) concluded, "the findings for optimizing both stress and performance were relatively weak" (p. 189).

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Study	Background Context	Key Findings
Mixed Intervention Reviews		
Gröpel & Mesagno (2019)	This systematic review synthesized studies on interventions to mitigate substandard performance in pressure situations (i.e., choking). Interventions were classified as distraction-based (i.e., "promote a task-relevant focus of attention during skill execution", p. 178), self-focus-based (i.e., "minimize the reinvestment of explicit knowledge and the conscious control of skill execution", p. 179), and acclimatization (i.e., reduce "the feelings of pressure that otherwise may lead to distraction or self-focus", p. 179).	36 articles met the inclusion criteria and involved 47 separate intervention studies. Seven studies implemented distraction-based interventions, 32 studies implemented self-focus-based interventions, and 10 used acclimatization interventions. Two studies tested both self-focus-based and acclimatization interventions. Gröpel and Mesagno (2019) stated, "the most consistent (and positive) effects were obtained with PPR, QE training, left-hand contractions, the use of dual task, and practicing under self-consciousness and mild anxiety conditions" (p. 194).
Specific Intervention Reviews		
Biofeedback Jiménez Morgan, & Molina Mora (2017)	This systematic review examined evidence to support the use of heart rate variability feedback to improve sport performance.	Seven studies met the inclusion criteria, with Jiménez Morgan, and Molina Mora (2017) stating that six enhanced psychophysiological variables that improved sport performance.
Xiang et al. (2018)	This systematic, and meta-analytic, review examined the effects of neurofeedback training (NFT) on sport performance in randomized controlled trials (RCTs) with athletes.	10 RCTs met the inclusion criteria, with moderate to large beneficial effects of NFT for sport performance; however, NFT's effect on performance was not different when compared to well-controlled trials with active/placebo control.
Goal-setting Kyllo & Landers (1995)	In spite of the widespread use and popularity of goal-setting as a motivational technique, there appeared to be ambiguity regarding the effects of different types of goals (e.g., do your best, difficult goals). Furthermore, much of the sport-based literature was underpowered owing to small sample sizes. This meta-analytic review aimed to pool existing samples of goal-setting in sport and exercise.	36 studies met the inclusion criteria, with the overall mean effect size suggesting that goal-setting had a performance enhancing effect. Follow-up analysis indicated that moderate goals yielded a significant effect, whereas all other difficulty levels (i.e., improbable, difficult, and easy) were non-significant. Goal specificity and proximity also moderated intervention effectiveness.

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Study	Background Context	Key Findings
Mixed Intervention Reviews		
Mental practice		
Feltz & Landers (1983)	This study sought to review the literature on mental practice and motor skill learning using meta-analytical procedures, which enabled the pooling of results.	60 studies met the inclusion criteria. The results from the meta-analysis suggested that mental practice had positive effects on motor skill learning. This effect was significantly greater for cognitive, compared to strength or motor, tasks. Feltz and Landers (1983) found no significant difference between novice, and experienced, performers.
Hinshaw (1991)	Given the widespread use of mental practice this meta-analysis established an overall measurement of published research in the field.	21 published studies were included. The results from the meta-analysis indicated that there was a significant benefit to performance when using mental practice over no practice. Internal imagery produced a significantly larger effect than external imagery. Hinshaw (1991) found no significant difference for skill level (i.e., novice, intermediate, experienced, or mixed).
Driskell et al. (1994)	Given the inconsistent findings of mental practice research on performance, the purpose of this systematic, and meta-analytic, review was to synthesize existing literature and specify the conditions under which mental practice was most effective.	35 studies met the inclusion criteria, with findings indicating that mental practice had a positive, significant effect on performance. The type of task, retention interval between practice and performance, and length or duration of the intervention moderated the effectiveness of mental practice. Mental (compared to physical) practice was also less effective.
Mindfulness and acceptance-based		
Sappington & Longshore (2015)	This study sought to systematically review mindfulness interventions. Mindfulness practices aim to "promote a modified relationship with internal experiences . . . rather than seeking to change [them]" (Gardner & Moore, 2012, p. 309).	Four RCTs met the inclusion criteria, and were considered alongside 15 additional studies that used a case study ($n = 6$), qualitative ($n = 2$), or nonrandomized open trial ($n = 7$) design. Based on these 19 studies, Sappington and Longshore (2015) concluded preliminary support for the efficacy of mindfulness-based interventions to enhance sport performance.
Bühlmayer et al. (2017)	This meta-analysis examined to what extent mindfulness-based interventions affect performance-relevant physiology and psychological surrogates or performance itself.	Nine intervention trials met the inclusion criteria. Three studies examined performance outcomes, with mindfulness having a large, positive effect on precision sports (e.g., shooting and dart throwing).

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Study	Background Context	Key Findings
Mixed Intervention Reviews		
Noetel et al. (2019)	This systematic review sought to extend Sappington and Longshore (2015) review by synthesizing and critiquing research on mindfulness and acceptance approaches in individuals competing in sport.	66 studies met the inclusion criteria for a qualitative synthesis, with 43 studies evaluating an intervention. Noetel et al. (2019) suggested, "there is a dearth of high-quality studies and some inconsistent findings in support of mindfulness and acceptance approaches for performance enhancement." (p. 160).
Quiet eye (QE) training Lebeau et al. (2016)	This systematic, and meta-analytic, review sought to synthesize findings on the relationship between QE and sport performance.	Nine studies met the inclusion criteria for the evaluation of QE interventions on (sport or motor task) performance, finding a moderate-to-large, positive effect. Lebeau et al (2016) explained, "intervention programs designed to lengthen the QE period are effective in extending the gaze behaviors, which ultimately lead to performance improvement" (p. 454).
Relaxation Pelka et al. (2016)	The aim of this systematic review was to examine the acute effects of psychological relaxation techniques in sport performance. Relaxation techniques were separated into somatic and cognitive types, with the former focusing on the training of one's sensitivity to muscle tension (e.g., progressive muscle relaxation, biofeedback, yoga) and the latter of mind-to-muscle techniques (e.g., hypnosis, meditation).	21 studies met the inclusion criteria, where nine evaluated somatic interventions, five evaluated cognitive interventions, and seven compared somatic and cognitive techniques. Overall, 13 studies demonstrated a significant performance improvement when using a relaxation technique. Although somatic-, and cognitive-based, interventions revealed inconsistent results some techniques (e.g., biofeedback, hypnosis) showed positive effects more than others.
Self-talk Hatzigeorgiadis et al. (2011)	This meta-analytic review focused on the effects of self-talk interventions on sport performance and possible factors that may moderate the effectiveness of self-talk.	32 studies met the inclusion criteria and resulted in an overall positive moderate effect. Self-talk interventions were more effective: for novel (compared to well-learned) tasks, when using instructional (compared to motivational) self-talk, and in relatively fine (compared to gross) motor tasks. Hatzigeorgiadis et al. (2011) concluded, overall, self-talk was an effective strategy for enhancing sport performance.
Tod et al. (2011)	The purpose of this study was to systematically review the sports-oriented experimental self-talk literature with samples of varying competitive level.	47 studies met the inclusion criteria. Instructional (80% & 70%), and motivational (67% & 83%), self-talk had a positive effect on performance in precision-based tasks and gross motor skills, respectively. Tod et al. (2011) found additional support that self-talk can benefit athletic performance.

Educational PST approaches

Mental Practice

Mental practice (referred to as imagery) is the mental creation or re-creation of a sensory experience in the mind (Morris, Spittle, & Watts, 2005). Orlick and Partington (1988) initially found that 99% of 235 Canadian athletes used imagery prior to, or in preparation for, their events. Since the 1980s, researchers have determined the reasons for athletes' imagery use, provided explanations for its benefits, and devised models that support the effective application of imagery training (see Morris et al., 2005 for a review). In a systematic review (albeit not yet peer-reviewed), Lindsay, Spittle, and Larkin (2019) established that skill-based imagery improved athletic performance across a range of sports in 90% of the included (high-quality) studies, although sport situation, type of imagery used, imagery ability, and duration of imagery intervention moderated this positive effect.

Self-Talk

Researchers have understood that rational, optimistic thinking, and self-talk are coping strategies of successful athletes (e.g., Gould, Eklund, & Jackson, 1993). Yet, how athletes speak to themselves has only been investigated in-depth in the past 20 years. Hardy (2006) defined self-talk as: "(a) verbalizations or statements addressed to the self; (b) multidimensional in nature; (c) having interpretive elements association with the content of statements employed; (d) is somewhat dynamic; and (e) serves at least two functions; instructional and motivational, for the athlete" (p. 84). Self-talk research has progressed considerably since initial studies (e.g., Dagrou, Gauvin, & Halliwell, 1992), where the focus was on the effects of positive and negative self-talk on performance. Hatzigeorgiadis, Zourbanos, Galanis, and Theodorakis' (2011) meta-analysis, then found that self-talk was consistently, positively associated with improved performance (see Table 1 for more results). Similarly, Tod, Hardy, and Oliver (2011) found positive, motivational, and instructional self-talk were beneficial, with negative self-talk not always detrimental to performance. Such work has culminated in a sport-specific model of self-talk (see van Raalte, Vincent, & Brewer, 2016), which illustrates the importance of contextual (e.g., task difficulty, match circumstances, and coaching behaviours) and personal factors (e.g., personality traits) when discerning the impact of self-talk on the athlete's cognitions, emotions, and performance.

Goal-Setting

A goal is defined as "attaining a specific level of proficiency in a task, usually within a specified time limit" (Locke, Shaw, Saari, & Latham, 1981, p. 145), and involves documenting particular steps to attain an identified task. Most athletes apply goal-setting principles, yet successful athletes set practice goals more often than those who are less/unsuccessful (e.g., Orlick & Partington, 1988). Studies have examined goal-setting in sport (or motor tasks) since the 1970s (e.g., Barnett, 1977), yet, researchers only began to investigate goal-setting for performance enhancement in earnest after Locke and Latham (1985) suggested its application to sport. Thereafter, Burton and Weiss (2008) found that 80% (out of 88) of goal-setting studies in sport and exercise demonstrated moderate to strong performance effects, with greater benefits when goal-setting was included within a systematic psychological skills training program (e.g., Burton, 1989). Further, goal difficulty, specificity (fixed goals, rather than do your best), proximity, focus (i.e., mastery / performance), the athlete's commitment to the goal, and feedback regarding progression towards the goal, often moderates the impact of goal setting (Kingston & Wilson, 2009). More recently, Swann, Crust, and Vella (2017) reinforced the value of specific / fixed goals, for they appear to encourage optimal performance through engendering a "clutch" state.

Relaxation

Techniques involved in reducing arousal include (but are not limited to) progressive muscle relaxation (PMR; Jacobson, 1938), deep breathing techniques, relaxation response (Benson, 1975), autogenic training (Schultz & Luthe, 1969), meditation (of various types), and biofeedback. Originally, DeWitt (1980) investigated relaxation training in sport, by conducting two studies that included cognitive (i.e., relaxation, cognitive restructuring, and mental rehearsal) and biofeedback techniques in a training program. DeWitt found that athletes in both studies experienced significant performance improvements on objective measures compared to a control group. Little is known about the effectiveness of relaxation techniques separately, any individual differences among athletes regarding their success at relaxing, preferences for different relaxation techniques, or willingness to practice the techniques (Williams & Harris, 2006). Though, it is generally accepted that cognitive relaxation strategies should be applied to lower the cognitive element of the athlete's emotional response, whereas behavioral techniques can effectively lower somatic responses (see Thomas, Mellalieu, & Hanton, 2008).

Pre-Performance Routine

A pre-performance routine (PPR; also called a pre-shot routine) is any systematic cognitive and behavioral preparation strategy that an athlete engages in prior to performance execution (Cotterill, 2010). A PPR integrates a number of cognitive and / or behavioral psychological skills (e.g., imagery, self-talk, relaxation) to enhance performance. Athletes' PPR's have been investigated since the 1980s, where Crews and Boutcher (1986) monitored female professional golfers in tournaments and found that in comparison to less successful golfers (higher ranked), those who were more successful (lower ranked), took more time prior to their shots, indicating a better routine for mental preparation. Since then, researchers have found objective performance benefits of PPR such as improved performance for all skill levels (Cotterill, 2010), and elevated performance under pressure (see Gröpel & Mesagno, 2019 in Table 1 for a review). A dedicated systematic (or meta-analytic) review of PPRs does not currently exist, yet, Cotterill (2010) reviewed literature and concluded that better performers had more consistent routines regarding their composition and temporal duration, with routines more effective if they contained cognitive and behavior components.

Alternative PST approaches

Quiet Eye Training

Technological advances in sport have allowed the emergence and development of concentration training over the past 30 years, with specific visual search pattern measurements possible. Such concentration training primarily encourages athletes to visually focus more on task-relevant stimuli, while ignoring task-irrelevant cues. Using eye movement technology, researchers have identified visual search patterns, such as the quiet eye period, to develop effective concentration techniques for athletes. Quiet eye (QE) is defined as the final visual fixation toward a relevant target prior to the initiation of a movement (Vickers, 2007), and first appeared in the 1990s (e.g., Vickers, 1992). In terms of the latter, the studies found that after only one month, volleyball players tracked a ball earlier and longer than pre-intervention testing, and volleyball pass accuracy improved during competition by 7% over a three-year period. Furthermore, in a seminal study on QE training under pressure, Wood and Wilson (2011) found that QE training improved visual attention control and performance accuracy - although such improvement was not always maintained. Hence, longer QE fixations can improve performance (see LeBeau et al., 2016 in Table 1 for a review), with

QE training providing a specific method of increasing QE period and encouraging successful performance.

Biofeedback

Zaichkowsky (1975) first proposed biofeedback for performance enhancement in sport, but it has taken recent technological advancement (e.g., more sophisticated monitoring sensors), access to more affordable equipment, and a greater understanding of the wider psychological gains (e.g., motivational benefits) to reach sport performance environments (Pusenjak, Grad, Tusak, Leskovsek, & Schwarzlin, 2015). Biofeedback training programs are designed to provide athletes with external indicators relating to internal physiological response (e.g., heart rate, galvanic response, and muscular contraction) and, as a consequence, it has challenged the traditional thinking that such visceral responses are beyond an individuals' voluntary control. Recent reviews and meta-analyses (see Jiménez Morgan & Molina Mora, 2017; Xiang, Hou, Liao, Liao, & Hu, 2018 in Table 1) indicate that there is a prevalence of small sample research, and individual case studies, though there is a lack of comprehensive randomized control trial studies regarding the efficacy of biofeedback programs on performance. Nevertheless, the evidence indicates that biofeedback training, which encourages the athlete to recognise, monitor and manage the range of physiological markers can influence performance and athlete wellbeing positively. Indeed, Perry, Shaw, and Zaichkowsky (2011) proposed that biofeedback has the potential to address the criticism levelled at many applied sport psychology practitioners, regarding their inability to provide evidence that supports intervention efficacy. Increased accessibility of "over the counter" technology (e.g., Halo sport for transcranial direct current stimulation, focus band for neurofeedback use) that athletes can buy to gain psycho-physiological feedback (e.g., heart rate variability, galvanic skin response, & EMG) warrant further research attention regarding their efficacy and most effective use.

Contemporary Approaches To Promote Psychological Flexibility For Optimal Performance

Most approaches to enhance performance (under pressure) continue to be designed with the intention of either altering the content of internal experiences (i.e., thoughts, feelings, & physical sensation) or regulating attention toward the important components of skill execution (see Noetel, Ciarrochi, Van Zanden, & Lonsdale, 2019; Sappington & Longshore, 2015 in Table 1).

Psychological skills training programs, delivered by applied practitioners, have often attempted to achieve the former, though there has been an increased use of interventions designed to target the latter. Evidence of 'ironic rebound effects' (also referred to as ironic mental processes; Wegner, 1994; Wegner, Broome & Blumberg, 1997) offer support for this shift, as efforts to suppress unwanted internal experience can increase their occurrence (Wang, Hagger & Chatzisarantis, 2019). This reveals a paradox in which many interventions designed to impact performance positively, may create greater psychological stress or, at the least, result in any performance benefits coming at a psychological cost. Sappington and Longshore (2015) argues that "rather than attempt to control or ignore internal processes as in PST, individuals are encouraged to acknowledge and accept them as simply events in the ebb and flow of competition" (p. 234). Evaluation of current psychological strategies, therefore, requires a comparison between intentions to remove / lower (e.g., relaxation training) or 'perform with' (e.g., mindfulness and acceptance approaches) unwanted psychological experience.

Accordingly, approaches such as acceptance commitment therapy (ACT) and mindfulness represent a move away from the acquisition of psychological skills that manage or alter thoughts, feelings, and behavior when performing (under pressure), toward a focus on how athletes relate to what they think and feel. The emphasis within these approaches is the acceptance of internal processes as a 'normal' part of the athletic experience and being human, with the ability to maintain present moment focus within pressurized situations being the main goal. Within the overarching ACT framework, athletes engage in experiential exercises that target psychological flexibility through the development of open, centered, and engaged response styles. Interventions under the acceptance and mindfulness umbrella differ in the extent to which they focus on some, or all, of the core processes defined within ACT with different influences on outcomes observed (Noetel et al., 2017).

Many strategies that are central to educational PST that serve to alter internal states when performing, such as distraction and thought / emotional control techniques, would represent an intention toward experiential avoidance; which is the antithesis of acceptance. While PST is often designed to change the athlete's internal state, not all psychological strategies are incongruent with the aims of ACT and mindfulness. Some strategies may enable the athlete to accept current internal states and maintain moment-to-moment focus (e.g., PMR / process goals). There is currently tentative support for such ACT consistent strategies. For example, Noetel et al. (2017) found one meta-analysis conducted on the impact of self-talk interventions on task performance (Hatizgeorgiadis et al., 2011) in which only small-moderate pooled effect sizes were found for motivational self-talk that had the

intention of altering the content of unwanted internal experience (e.g., thoughts). In contrast, instructional self-talk interventions, designed to promote greater task focused attention, yielded larger effects.

Gardner and Moore's (2007) mindfulness and commitment (MAC) approach specifically addressed the limited research supporting PST techniques that target the elimination of distress. The MAC protocol takes athletes through a range of techniques aimed at "increasing mindful awareness and non-judgmental acceptance of in-the-moment cognitive, sensory, and affective experiences" (Gross et al., 2018, p. 433). Strategies that include mindfulness, cognitive defusion, experiential acceptance, and values identification are implemented to target the MAC's suggested mechanisms of change, which consist of enhanced attentional awareness, non-judgmental task-relevant focus, enhanced emotion regulation, and increased psychological flexibility in response to the internal and external demands faced by athletes performing under pressure. Among others, Gross et al. sought to evaluate the MAC approaches effectiveness in enhancing performance against more traditional PST, where female basketball players ($N = 22$) were assigned to either a MAC or PST group and engaged in seven weeks of 60-minute training. The MAC intervention had a greater impact (than the PST group) on behavioral issues (e.g., substance abuse), within group changes over the training period (e.g., reduced generalized anxiety and psychological distress), and improved performance as determined by coach ratings.

Despite the emergence of MAC approaches in sport, there is minimal empirical support for intervention efficacy regarding performance enhancement specifically. Instead, studies have focused on the impact the approaches can have on other psychological variables (i.e., anxiety, self-efficacy, emotion regulation). Noetel et al. (2017) reviewed 66 studies of any design in which 3,908 athletes of all skill levels, from a range of sports, completed MAC interventions. Noetel et al. found consistent support for the influence of the mindfulness / MAC interventions on self-reported mindfulness and increased flow, with low-quality evidence for the reduction of anxiety. Yet performance enhancement findings, although promising, were mixed. Only one study (i.e., Zhang et al., 2016) reported a statistically significant increase in performance. Therefore, researchers should complete high-quality empirical work to establishes if such approaches are worthy of further consideration by applied practitioners working with athletes.

Future Directions for Applied PST Interventions The Use of Technology

Technological advancements are already influencing sport psychology research and applied work, as reflected by the advent of QE training and

biofeedback. There is also an emerging evidence regarding the application of neurofeedback training (NFT; Xiang et al., 2018). While an extensive explanation and review is beyond the scope of this article, NFT is based on the premise that optimal skill execution is associated with a distinct pattern of cortical activity (as measured by electroencephalography; EEG). Specifically, when planning and executing a skill, elite athletes have lower levels of activation in the left hemisphere language areas, compared to novice performers (e.g., Hatfield, Haufler, Hung, & Spalding, 2004). Further, reduced levels of left hemisphere cortical activation tend to occur as athletes acquire / learn a motor skill (Landers et al., 1994). Therefore, NFT provides athletes with feedback that can teach them to voluntarily control the activation pattern of their cerebral cortices, in order to optimize performance (see Xiang et al., 2018 in Table 1). In addition, when combined with other approaches such as mindfulness (see Ford, Wyckoff, & Sherlin, 2016), the potential impact of neurofeedback may be increased. For example, the provision of psychophysiology indicators affords the opportunity to quantify a 'mindful state' and enable the athlete to volitionally (re-) create it. Further commercialization of the equipment is required to lower its cost and increase its accessibility for athletes and practitioners.

Another technological advancement that may inform future PST is virtual reality (VR; Düking, Holmberg, & Sperlich, 2018). VR aims to replace real-life scenarios with computer-generated, real-time immersive sensory experiences (Banos et al., 2000). Using VR for enhanced performance is not new, but its reduced cost and availability has allowed researchers to examine its potential as a PST tool (see Bird, 2019). An immersive and well-constructed VR experience can prompt an emotional response that is close to that found within real-life situations (see Krijn, Emmelkamp, Olafsson, & Biemond, 2004), and exposes athletes to pressurized conditions within the laboratory setting and / or during training. A key strength of VR is enabling the athlete to develop their physical and psychological skills under levels of pressure that are representative of competition, and to facilitate their preparation for unfamiliar, novel, and challenging sporting scenarios (Bird, 2019). As a result, the likelihood of experiencing optimal performance during subsequent real-life performances is increased (Duking et al., 2018). VR systems often provide bio / neurofeedback, and so can also be used to monitor the athlete's psychophysiological responses to pressure, and evidence progression as they embed their psychological skills and / or mindfulness training (Düking et al., 2018). One limitation of VR is that the equipment is more suited to skills where there is minimal movement, and for sports where there is little interaction with objects. The latter is due to the challenges associated with perception-action coupling (e.g., hitting a golf or tennis ball; see Bird, 2019; Düking et al., 2018 for a review of limitations).

Delivering Applied Sport Psychology On-Line

Due to the importance of the client-practitioner relationship and their interaction within the athlete's sporting environment (Sharp & Hodge, 2013), effective delivery of PST has often occurred in person. However, relying on one-on-one, face-to-face consultancy may be limiting the reach of sport psychology (i.e., to athletes, coaches and parents), which can be addressed through the delivery of psychological programs on-line (Weinberg, Neff, & Jurica, 2012). The remote provision of counselling psychological support has occurred for over 10 years (e.g., email and videoconferencing), with evidence demonstrating that on-line programmes can have a positive impact on a variety of mental health disorders (e.g., Ruwaard, Lange, Schrieken & Emmelkamp, 2011). To date, however, the evidence regarding the impact of on-line sport psychology delivery is less developed, with most available literature offering practical advice (see Cottrell, McMillen & Harris, 2018) and reinforcing ethical guidance (i.e., British Psychological Society guidelines). Therefore, further empirical evidence regarding on-line applied sport psychology consultancy for improved athletic performance is warranted.

Understanding and Managing Sporting Failure using the Post-Performance Period

While practitioners and researchers mainly focus on devising PST that encourage optimal performance, there is value in identifying approaches that directly target the prevention of performance failure, especially for those susceptible to choking under pressure (e.g., Hill, Hanton, Matthews, & Fleming, 2011). Choking under pressure (i.e., choking) explanations were initially proposed in the 1980's (e.g., Baumeister, 1984), with studies identifying it was caused by distraction (i.e., focusing on irrelevant factors) and / or self-focus (i.e., controlling explicit components of the skill during its execution; see Mesagno, Geukes, & Larkin, 2015 for a mechanistic and theoretical review). Thus, applied sport psychologists should devise PST that address the mechanisms through which an athlete has experienced choking (i.e., distraction or self-focus; see Gröpel, & Mesagno, 2019 for review of specific strategies). Choking is associated with a loss of optimal focus due to high levels of debilitative anxiety and a loss of perceived control (Hill, Cheesbrough, Gorczynski, & Matthews, 2019). Those working with choking-susceptible athletes should also consider the provision of PST, which lower / reappraise debilitative anxiety, increase levels of perceived control, or encourage mind-

fulness-acceptance to enable optimal (moment-to-moment) focus (Hussey, Weinberg, & Assar, 2020).

Alongside other research (e.g., adversity related growth, Howells, Sarkar & Fletcher, 2017), contemporary choking literature highlights the importance of working with athletes after performance failure. This ensures that athletes use the negative episode constructively and prevent it from affecting their wellbeing and future performances detrimentally (see Hill et al., 2019). Researchers exploring athletic experiences (both good and bad) *after* competitive performance could support athletes to manage successful / unsuccessful performances effectively, and influence future psychological states to promote optimal performances.

Conclusions

In the past half century, sport psychology interventions have substantially progressed to enhance performance. Researchers have identified many educational and alternative PST approaches, and contemporary interventions, that may help improve performance. Yet, in the next half century, it will be exciting to see how sport psychology researchers build on the foundation undertaken since the origins of PST.

REFERENCES

Banos, R. M., Botella, C., Garcia-Palacios, A., Villa, H., Perpina, C., & Alcaniz, M. (2000). Presence and reality judgment in virtual environments: A unitary construct? *Cyberpsychology Behaviour, 3*, 327-335. doi:10. 1089/10949310050078760.

Barnett, M. L. (1977). Effects of two methods of goal setting on learning a gross motor task. *Research Quarterly, 48*, 19-23. doi.org/10.1080/10671315.1977.10762144

Baumeister, R. F. (1984). Choking under pressure: Self-consciousness and paradoxical effects of incentives on skillful performance. *Journal of Personality and Social Psychology, 46*, 610-620. doi.org/10.1037/0022-3514.46.3.610

Benson, H. (1975). The relaxation response. New York: Morrow.

Bird, J. M. (2019). The use of virtual reality head-mounted displays within applied sport psychology. *Journal of Sport Psychology in Action, 10*, 1-14. doi.10.1080/21520704.2018.1563573.

Brown, D. J., & Fletcher, D. (2017). Effects of psychological and psychosocial interventions on sport performance: *A meta-analysis. Sports Medicine, 41*, 77-99. doi:10.1007/s40279-016-0552-7

Bühlmayer, L., Birrer, D., Röthlin, P., Faude, O., & Donath, L. (2017). Effects of mindfulness practice on performance-relevant parameters and performance outcomes in sports: A meta-analytical review. *Sports Medicine, 47*, 2309-2321. doi:10.1007/s40279-017-0752-9

Burton, D. (1989). Winning isn't everything: Examining the impact of performance goals on collegiate swimmers' cognitions and performance. *The Sport Psychologist, 3*, 105-132. doi.org/10.1123/tsp.3.2.105

Burton, D., & Weiss, C. (2008). The fundamental goal concept: The path to process and per-

formance success. In T. Horn (Ed.), Advances in sport psychology (3rd ed., pp. 339-375). Champaign, IL: Human Kinetics.
Cotterill, S. (2010). Pre-performance routines in sport: Current understanding and future directions. *International Review of Sport and Exercise Psychology, 3*, 132-153. doi.org/10.1080/1750984X.2010.488269
Cottrell, C., McMillen, N., & Harris, B. S. (2019). Sport psychology in a virtual world: Considerations for practitioners working in eSports. *Journal of Sport Psychology in Action, 10*, 73-81. doi.org/10.1080/21520704.2018.1518280.
Crews, D. J., & Boutcher, S. H. (1986). An exploratory observational behavior analysis of professional golfers during competition. *Journal of Sport Behavior, 9*, 51-58.
Dagrou, E., Gauvin, L., & Halliwell, W. (1992). Effets du langage positif, negative, et neutre sur la performance mortice. *Canadian Journal of Sport Sciences, 17*, 145-147.
DeWitt, D. J. (1980). Cognitive and biofeedback training for stress reduction with university athletes. *Journal of Sport Psychology, 2*, 288–294. doi.org/10.1123/jsp.2.4.288
Driskell, J. E., Copper, C., & Moran, A. (1994). Does mental practice enhance performance? *Journal of Applied Psychology, 79*, 481-492. doi:10.1037/0021-9010.79.4.481
Düking P., Holmberg, H-C., & Sperlich, B. (2018). The potential usefulness of virtual reality systems for athletes: A short SWOT analysis. *Frontiers of Physiology, 9,* 128. doi.10.3389/fphys.2018.00128.
Feltz, D. L., & Landers, D. M. (1983). The effects of mental practice on motor skill learning and performance: A meta-analysis. *Journal of Sport Psychology, 5*, 25-57.
Ford, N. L., Wyckoff, S. N., & Sherlin, L. H. (2016). Neurofeedback and mindfulness in peak performance training among athletes. *Biofeedback*, *44*, 152-159. doi.org/10.5298/1081-5937-44.3.11.
Gardner, F.L., & Moore, Z.E. (2007). *The psychology of enhancing human performance: The mindfulness-acceptance-commitment approach*. New York: Springer.
Gould, D., Eklund, R. C., & Jackson, S. A. (1993). Coping strategies used by U.S. Olympic wrestlers. *Research Quarterly for Exercise and Sport, 64*, 89-93. doi.org/10.1080/02701367.1993.10608782
Greenspan, M. J., & Feltz, D. L. (1989). Psychological interventions with athletes in competitive situations: A review. *The Sport Psychologist, 3*, 219-236. doi:10.1123/tsp.3.3.219
Gröpel, P., & Mesagno, C. (2019). Choking interventions in sports: A systematic review. *International Review of Sport and Exercise Psychology, 12*, 176-201. doi:10.1080/1750984X.2017.1408134
Gross, M., Moore, Z. E., Gardner, F. L., Wolanin, A. T., Pess, R., & Marks, D. R. (2018). An empirical examination comparing the mindfulness-acceptance-commitment approach and psychological skills training for the mental health and sport performance of female student athletes. *International Journal of Sport and Exercise Psychology*, *16*(4), 431-451.
Gross, M., Moore, Z. E., Gardner, F. L., Wolanin, A. T., Pess, R., & Marks, D. R. (2018). An empirical examination comparing the mindfulness-acceptance-commitment approach and psychological skills training for the mental health and sport performance of female student athletes. *International Journal of Sport and Exercise Psychology*, *16*, 431-451.
Hardy, J. (2006). Speaking clearly: A critical review of the self-talk literature. *Psychology of Sport and Exercise, 7,* 81-97. http://dx.doi.org/10.1016/j.psychsport.2005.04.002
Hatfield, B. D., Haufler, A. J., Hung, T. M., & Spalding, T. W. (2004). Electroencephalographic studies of skilled psychomotor performance. *Journal of Clinical Neurophysiology, 21*, 144-156.
Hatzigeorgiadis, A., Zourbanos, N., Galanis, E., & Theodorakis, Y. (2011). Self-talk and sports performance: A meta-analysis. *Perspectives on Psychological Science, 6*, 348–56. doi:10.1177/1745691611413136
Hill, D. M., Cheesbrough, M., Gorczynski, P., & Matthews, N. (2019). The consequences of choking in sport: A constructive or destructive experience? *The Sport Psychologist*, *33*, 12-22. doi.org/10.1123/tsp.2018-0070.
Hill, D. M., Hanton, S., Matthews, N., & Fleming, S. (2011). Alleviation of choking under pressure in elite golf: An action research study. *The Sport Psychologist, 25*, 465-488. doi.org/10.1123/tsp.25.4.465

Hinshaw, K. E. (1991). The effects of mental practice on motor skill performance: Critical evaluation and meta-analysis. *Imagination, Cognition, and Personality, 11*, 3-35. doi:10.2190/X9BA-KJ68-07AN-QMJ8

Howells, K., Sarkar, M., & Fletcher, D. (2017). Can athletes benefit from difficulty? A systematic review of growth following adversity in competitive sport. *Progress in brain research, 234*, 117-159. doi.org/10.1016/bs.pbr.2017.06.002

Hussey, J., Weinberg, R., & Assar, A. (2020). Mindfulness in Sport: An Intervention for a Choking-Susceptible Athlete. Case Studies in Sport and Exercise Psychology, 4, 1-10. doi.org/10.1123/cssep.2019-0025.

Jacobson, E. (1938). *Progressive relaxation.* Chicago: University of Chicago Press.

Jiménez Morgan, S., & Molina Mora, J. A. (2017). Effect of heart rate variability biofeedback on sport performance: A systematic review. *Applied Psychophysiology and Biofeedback, 42*, 235-245. doi:10.1007/s10484-017-9364-2

Krijn, M., Emmelkamp, P. M., Olafsson, R. P., & Biemond, R. (2004). Virtual reality exposure therapy of anxiety disorders: A review. *Clinical Psychology Review*, *24*, 259-281. doi.org/10.1016/j.cpr.2004.04.001

Kingston, K., & Wilson, K. (2009). The application of goal setting in sport. In. S. D. Mellalieu, & S. Hanton (Eds.), Advances in applied sport psychology: A review (pp. 75-123). Abingdon, Oxon. Routledge.

Kyllo, L. B., & Landers, D. M. (1995). Goal setting in sport and exercise: A research synthesis to resolve the controversy. *Journal of Sport & Exercise Psychology, 17*, 117-137. doi.org/10.1123/jsep.17.2.117

Landers, D. M., Han, M. W., Salazar, W., Petruzzello, S., Kubitz, K. A., & Gannon, T. L. (1994). Effects of learning on electroencephalographic and electrocardiographic patterns in novice archers. *International Journal of Sport Psychology, 25*, 3, 313-330

Lebeau, J. C., Liu, S., Sáenz-Moncaleano, C., Sanduvete-Chaves, S., Chacón-Moscoso, S., Becker, B. J., & Tenenbaum, G. (2016). Quiet eye and performance in sport: A meta-analysis. *Journal of Sport & Exercise Psychology, 38*, 441-457. doi:10.1123/jsep.2015-0123

Lindsay, R., Spittle, M., & Larkin, P. (2019). The effect of mental imagery on skill performance in sport: A systematic review. *Journal of Science and Medicine in Sport*, *22*, S92. doi.org/10.1016/j.jsams.2019.08.111

Locke, E. A., Shaw, K. N., Saari, L. M., & Latham, G. P. (1981). Goal setting and task performance. *Psychological Bulletin, 90*, 125-152. doi.org/10.1037/0033-2909.90.1.125

Locke, E. A., & Latham, G. P. (1985). The application of goal setting to sports. *Journal of Sport & Exercise Psychology, 7*, 205-222. doi.org/10.1123/jsp.7.3.205

Mahoney, M. J., & Avener, M. (1977). Psychology of the elite athlete: An exploratory study. *Cognitive Therapy and Research, 1*, 135-141.

Mahoney, M. J., Gabriel, T. J., & Perkins, T. S. (1987). Psychological skills and exceptional athletic performance. *The Sport Psychologist, 1*, 181-199. doi.org/10.1123/tsp.1.3.181

Martin, G. L., Thompson, K., & Regehr, K. (2004). Studies using single-subject designs in sport psychology: 30 years of research. *The Behavior Analyst, 27*, 263-280.

Martin, G. L., Vause, T., & Schwartzman, L. H. (2005). Experimental studies of psychological interventions with athletes in competitions: Why so few? *Behavior Modification, 29*, 616-641. doi:10.1177/0145445503259394

Mesagno, C., Geukes, K., & Larkin, P. (2015). Choking under pressure: A review of current debates, literature, and interventions. In S. D. Mellalieu & S. Hanton (Eds.), *Contemporary advances in sport psychology: A review* (pp. 148–174). Abingdon, UK: Routledge, Taylor & Francis Group.

Meyers, A. W., Cooke, C. J., Cullen, J., & Liles, L. (1979). Psychological aspects of athletic competition: A replication across sports. *Cognitive Therapy and Research, 3*, 361-366. doi.org/10.1007/BF01184450

Morris, T., Spittle, M., & Watts, A. P. (2005). *Imagery in sport.* Champaign, IL: Human Kinetics.

Noetel, M., Ciarrochi, J., Van Zanden, B., & Lonsdale, C. (2019). Mindfulness and acceptance approaches to sporting performance enhancement: A systematic review. *International Review of Sport and Exercise Psychology, 12*, 139-175. doi:10.1080/1750984X.2017.1387803

Orlick, T., & Partington, J. (1988). Mental links to excellence. *The Sport Psychologist, 2*, 105-130. doi.org/10.1123/tsp.2.2.105

Thomas, O., Mellalieu, S. D., & Hanton, S. (2008). Stress management in applied sport psychology. In S. D. Mellalieu., & S. Hanton (Eds.), *Advances in Applied Sport Psychology* (pp. 134-171). Abingdon, Oxon: Routledge.
Pelka, M., Heidari, J., Ferrauti, A., Meyer, T., Pfeiffer, M., & Kellmann, M. (2016). Relaxation techniques in sports: A systematic review on acute effects on performance. *Performance Enhancement & Health, 5*, 47-59. doi:10.1016/j.peh.2016.05.003
Perry, F. D., Shaw, L., & Zaichkowsky, L. (2011). Biofeedback and neurofeedback in sports. *Biofeedback*, *39*, 95–100. http://dx.doi.org/10.5298/1081-5937-39.3.10
Pusenjak, N., Grad, A., Tusak, M., Leskovsek, M., & Schwarzlin, R. (2015). Can biofeedback training of psychophysiological responses enhance athletes' sport performance? A practitioner's perspective. *The Physician and Sportsmedicine*, *43*(3), 287-299.
Rumbold, J. L., Fletcher, D., & Daniels, K. (2012). A systematic review of stress management interventions with sport performers. *Sport, Exercise, and Performance Psychology, 1*, 173-193. doi:10.1037/a0026628
Ruwaard, J., Lange, A., Schrieken, B., & Emmelkamp, P. M. (2011). Efficacy and effectiveness of online cognitive behavioral treatment: A decade of interapy research. In. B. K. Wiederhold., S. Bouchard, & O. Gatineau, (Eds.), *Annual Review of Cybertherapy and Telemedicine: Evidence-Based Clinical Applications of Information Technology* (pp.7-10). San Diego, CA: Interactive Media Institute.
Sappington, R., & Longshore, K. (2015). Systematically reviewing the efficacy of mindfulness-based interventions for enhanced athletic performance. *Journal of Clinical Sport Psychology*, *9*, 232– 262. doi:10.1123/jcsp.2014-0017
Sharp, L. A., & Hodge, K. (2013). Effective sport psychology consulting relationships: Two coach case studies. *The Sport Psychologist*, *27*, 313-324. doi.org/10.1123/tsp.27.4.313
Schultz, J., & Luthe, W. (1969). *Autogenic methods.* New York: Grune & Stratton.
Swann, C., Crust, L., & Vella, S. A. (2017). New directions in the psychology of optimal performance in sport: Flow and clutch states. *Current Opinion in Psychology, 16*, 48-53. doi.org/10.1016/j.copsyc.2017.03.032
Tod, D., Hardy, J., & Oliver, E. (2011). Effects of self-talk: A systematic review. *Journal of Sport & Exercise Psychology, 33*, 666-687. doi.org/10.1123/jsep.33.5.666
van Raalte, J. L., Vincent, A., & Brewer, B. W. (2016). Self-talk: Review and sport-specific model. *Psychology of Sport and Exercise, 22*, 139-148. doi.org/10.1016/j.psychsport.2015.08.004
Vealey, R. S. (1988). Future directions in psychological skills training. *The Sport Psychologist, 2*, 318-336. doi.org/10.1123/tsp.2.4.318
Vealey, R. S. (1994). Current status and prominent issues in sport psychology interventions. *Medicine and Science in Sports and Exercise, 26*, 495-502. doi:10.1249/00005768-199404000-00015
Vickers, J. N. (1992). Gaze control in putting. *Perception*, *21*, 117-132. doi.org/10.1068/p210117
Vickers, J.N. (2007). *Perception, cognition and decision training: The quiet eye in action.* Champaign, IL: Human Kinetics.
Wang, D., Hagger, M. S., & Chatzisarantis, N. L. D. (2019). Ironic effects of thought suppression: A meta-analysis. *Perspectives on Psychological Science.* https://doi.org/10.31234/osf.io/c64fp
Wegner, D. M. (1994). Ironic processes of mental control. *Psychological Review, 101*, 34–52.
Wegner, D. M., Broome, A., & Blumberg, S. J. (1997). Ironic effects of trying to relax under pressure. *Behavioral Research and Therapy, 35*, 11-21.
Weinberg, R. S., & Comar, W. (1994). The effectiveness of psychological interventions in competitive sport. *Sports Medicine, 18*, 406-418. doi:10.2165/00007256-199418060-00005
Weinberg, R., Neff, R., & Jurica, B. (2012). Online mental training: Making it available for the masses. *Journal of Sport Psychology in Action*, *3*, 182-192. doi.org/10.1080/21520704.2012.656833
Williams, J. M., & Harris, D. V. (2006). Relaxation and energizing techniques for regulation of arousal. In J. M. Williams (5th Ed.), *Applied sport psychology: Personal growth to peak performance* (pp. 285–305). New York: McGraw-Hill.
Wood, G., & Wilson, M. R. (2011). Quiet-eye training for soccer penalty kicks. *Cognitive Processing, 12*, 257-266.

Xiang, M.-Q., Hou, X.-H., Liao, B.-G., Liao, J.-W., & Hu, M. (2018). The effect of neurofeedback training for sport performance in athletes: A meta-analysis. *Psychology of Sport and Exercise, 36*, 114-122. doi:10.1016/j.psychsport.2018.02.004

Zaichkowsky, L. D. (1975, October). Combating stress: What about relaxation training and biofeedback? Mouvement, pp. 309–312.

Zhang, C. Q., Si, G., Duan, Y., Lyu, Y., Keatley, D. A., & Chan, D. K. C. (2016). The effects of mindfulness training on beginners' skill acquisition in dart throwing: A randomized controlled trial. Psychology of Sport and Exercise, 22, 279–285. doi:10.1016/j.psychsport.2015.09.005