

Mindfulness in Sport Performance

Timothy R. Pineau, Carol R. Glass, & Keith A. Kaufman

The Catholic University of America

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Abstract

This chapter reviews the literature on mindfulness in sport performance, while attempting to explore possible points of integration between two conceptualizations of mindfulness: Ellen Langer's social psychology-based definition, and the definition of mindfulness that is rooted in Eastern philosophy and has been popularized by authors like Jon Kabat-Zinn. Mindful Sport Performance Enhancement (MSPE) and other mindfulness-based interventions designed specifically for athletes are discussed. In addition, an overview of the research examining the associations between mindfulness and important sport performance-related topics is presented, including flow, attention, affect, and physiological factors. Although most existing research has utilized the Eastern perspective, a particular focus is given to the empirical and theoretical connections between sport performance and Langer's conceptualization of mindfulness. These two ideas of mindfulness may compliment each other, and future mindfulness-based interventions for athletes may be improved by attempting to integrate them.

Mindfulness in Sport Performance

Traditional sport psychology interventions, such as imagery, self-talk, and goal setting (Weinberg & Gould, 2011), generally aim to facilitate optimal performance by helping to control the internal, mental factors that can affect athletes (Gardner & Moore, 2006). Although these techniques have amassed support and are used around the world, investigations of these interventions have yielded inconsistent results and are often wrought with methodological flaws (Birrer & Morgan, 2010; Meyers, Whelan, & Murphy, 1996).

Gardner and Moore (2006) argue that the equivocal support for these traditional interventions may be due to the fact that their premise is flawed. Citing work by Wegner (1994), they propose that attempting to control negative internal states may ironically increase their occurrence by priming athletes to search for these phenomena. Such scanning can adversely impact sport performance, both by making negative thoughts and feelings more prominent in conscious awareness, and by distracting attention from the task at hand (Bertollo, Saltarelli, & Robazza, 2009; Janelle, 1999). Thus, rather than trying to control internal phenomena, it may be more beneficial for athletes to develop skills in present-moment awareness and acceptance (Gardner & Moore, 2006; Kaufman, Glass, & Arnkoff, 2009). This paradigm-shifting notion is a central tenet of an emerging group of treatments in sport psychology referred to as mindfulness-based interventions.

Psychological research on mindfulness began in part in the 1970's and 1980's (Kabat-Zinn, 1982; Kabat-Zinn, Lipworth, & Burney, 1985; Kabat-Zinn, Lipworth, Burney, & Sellers, 1987; Langer, 1977; Langer & Abelson, 1972; Langer, Blank, & Chanowitz, 1978; Langer & Imber, 1979) in two independent labs, working with two different conceptualizations of the construct. Langer's (2000) concept of mindfulness as "a flexible state of mind in which we are

actively engaged in the present, noticing new things and sensitive to context” (p. 220) is rooted in the theories and research of social psychology. According to Langer (1989), being mindful means noticing the context in which one acts. In this view, there is a particular emphasis on the active processing of new information, and the recognition that all stimuli can be seen from multiple perspectives. Langer contends that the capacity to see these various, situation-dependent points of view enhances one’s ability to respond to the environment effectively and appropriately.

Kabat-Zinn’s definition of mindfulness, on the other hand, has its roots in Buddhist philosophy, and involves “paying attention in a particular way: on purpose, in the present moment, and nonjudgmentally” (Kabat-Zinn, 1994, p. 4). For those who conceptualize the construct in this way, mindfulness is not the active processing of context-dependent information, but instead is a nonreactive awareness and unconditional acceptance of whatever arises in the present-moment. This Eastern conceptualization of mindfulness has been used more widely to date by clinical psychologists, and is the primary perspective underlying approaches to sport performance enhancement (e.g., Gardner & Moore, 2004, 2007; Kaufman & Glass, 2006).

These two definitions of mindfulness share some important characteristics, like engagement with the present moment, although the different cultural and historical contexts in which these concepts originated have generated important differences that must be considered (Baer, 2003; Langer, 1989). A thoughtful examination of these theoretical similarities and differences will be explored throughout this chapter, which may highlight how each can contribute to this new direction in sport psychology. For the purposes of the present discussion, the two approaches will be referred to as Langer’s mindfulness (LM) and Eastern mindfulness (EM). Any mention of *meditation* or a mindfulness-based *intervention* is referring to the Eastern

conceptualization of mindfulness, since Langer's mindfulness is not associated with meditation, and to date, there are no interventions based on Langer's definition in the area of sport.

This chapter will begin by reviewing the existing mindfulness-based interventions for athletes, paying particular attention to Mindful Sport Performance Enhancement (MSPE) developed by Kaufman and Glass (2006). Then, the associations between mindfulness and four important sport performance-related variables (flow, attention, affect, and certain physiological factors) will be examined, and their empirical and theoretical connections with EM and LM will be presented. These discussions will attempt to illuminate points of integration and divergence between the two conceptualizations of mindfulness, in an effort to create a more comprehensive understanding of the multifaceted role of mindfulness in sport performance enhancement.

Mindfulness-based Interventions

In the first empirical test of a mindfulness-based intervention for athletes, Kabat-Zinn, Beall, and Rippe (1985) found that, following mindfulness training, a group of college rowers performed well above their coach's expectations (based on experience level and physical ability), and a group of Olympic rowers, several of whom won medals, reported feeling that the training had helped their performance. Despite these promising early results, it was nearly two decades before more rigorous empirical investigations of mindfulness-based interventions for sport performance enhancement were conducted. Currently, there are two empirically supported approaches specifically for athletes, both of which utilize the Eastern definition of mindfulness: Kaufman and Glass' (2006) Mindful Sport Performance Enhancement (MSPE), and Gardner and Moore's (2004, 2007) Mindfulness-Acceptance-Commitment (MAC) approach. While MSPE will be the main focus of this discussion, the MAC approach and other recent interventions for

athletes will be briefly introduced, along with an example of LM that may be relevant to a discussion of improving sport performance.

Mindful Sport Performance Enhancement (MSPE)

Development. In 2006, Kaufman and Glass developed Mindful Sport Performance Enhancement (MSPE; Kaufman & Glass, 2006). This intervention draws from both Kabat-Zinn's (1990) Mindfulness-Based Stress Reduction (MBSR), and Segal, Williams, and Teasdale's (2002) Mindfulness-Based Cognitive Therapy (MBCT), as well as other relevant sources related to mindfulness and sports (e.g., Gallwey, 1974; Herrigel, 1953). MSPE is structured to be adaptable to any sport of focus. The initial version of the manual, which was designed as a 4-week protocol, incorporated concepts from books on archery (Lee & de Bondt, 2005), golf (Rotella & Cullen, 2004), and running (Dreyer & Dreyer, 2009), since athletes from those sports were included in the earliest studies of this approach. An expanded version of the MSPE manual has recently been created, and used in a current study with long-distance runners.

Description of MSPE. The expanded version of MSPE is a 6-week program consisting of weekly 90-minute group sessions and daily home practice (Kaufman, Glass, & Pineau, 2012; see Appendix A for a treatment outline). Original scripts were developed for all MSPE mindfulness exercises, and CD recordings of these exercises are provided to guide home practice. The intention of MSPE is to train athletes in the fundamentals of cultivating mindfulness, and then to help them gradually apply mindfulness skills both to their sport performance routines and lives beyond sport. In the initial sessions, an orientation and sport-specific rationale are presented to the athletes, which includes an explanation of what mindfulness is, how mindfulness training can be useful for athletes, and how the skills taught in MSPE are directly applicable to their sport. Core exercises included in the protocol are: (1) a

candy exercise, a variant of the raisin exercise used by Kabat-Zinn (1990) and Segal et al. (2002), which introduces the concept of awareness by having athletes focus on using all of their senses while slowly eating pieces of chocolate; (2) a sitting meditation that increases in length over the course of the workshop from 10 to almost 25 minutes, in which athletes are first guided to focus on their breath, then the sensations in their bodies, and finally to the sounds around them; (3) a body scan, during which athletes direct their attention to different areas of their body in sequence from their feet to their head, while being guided to notice and accept whatever sensations arise; (4) mindful yoga, which includes a series of basic yoga poses that allow athletes to practice maintaining a mindful awareness of their bodies and minds while they are in motion; (5) a walking meditation, in which athletes are guided to be fully aware of the sensations they experience within their bodies as they slowly transition from standing to walking at varying speeds; and (6) a sport-specific meditation (e.g., a running meditation), designed to give athletes the opportunity to apply the mindfulness skills they have developed throughout the workshop to the actual motions and sensations that they experience when participating in their sport.

The order in which these core exercises are taught progressively moves athletes from sedentary to active mindfulness practice. The culmination of this progression from mindfulness in stillness to mindfulness in motion is the introduction of the sport-specific meditation, which is intended create the necessary bridge between cultivating mindfulness and applying mindfulness during sport participation. The inclusion of an applied sport meditation and a rationale for the training that is adaptable to any sport represents a unique contribution of MSPE.

Empirical evidence for MSPE. Two studies (De Petrillo, Kaufman, Glass, & Arnkoff, 2009; Kaufman et al., 2009) and one follow-up investigation (Thompson, Kaufman, De Petrillo, Glass, & Arnkoff, 2011a) have been completed using the 4-week version of MSPE, and a

controlled examination of the expanded 6-week version is currently underway (Pineau, Kaufman & Glass, 2012). Using a community sample of archers and golfers, Kaufman et al. (2009) found significant increases in aspects of state and trait mindfulness for the golfers, in overall trait mindfulness for the archers, and in state flow for the whole sample. Flow, detailed later in this chapter, is the psychological construct thought to most closely approximate what athletes commonly refer to as “the zone.” Additionally, post-workshop feedback indicated that the athletes felt the MSPE workshop had positively impacted their performance and that they expected additional benefit in the future. De Petrillo et al. (2009) tailored the 4-week MSPE protocol to runners and found a significant increase in state mindfulness and a dimension of trait mindfulness from pre- to post-intervention, as well as significant decreases in aspects of sport-related anxiety and perfectionism. However, no significant performance changes were found (measured by self-reported best mile time pre- and post-intervention).

A 1-year follow-up of the archers, golfers, and runners who had received the MSPE training in the earlier studies showed that the athletes experienced a significant increase in trait mindfulness since receiving the workshop (Thompson et al., 2011a). Additionally, both the golfers and runners reported significantly improved performance (i.e., self-reported 18-hole practice round scores and mile times, respectively) since the conclusion of the workshop. Without a control group, it is impossible to say if these changes were a result of the MSPE training over and above the additional year of experience the athletes had in their sport, but other results at follow up suggest this possibility. Specifically, improvements in the golfers’ scores were significantly related to increases in the unambiguous feedback dimension of trait flow, and the runners’ performance improvement was associated with increases in mindfulness. These results may be particularly important given that Kaufman et al. (2009) observed a significant

increase in the unambiguous feedback dimension of state flow from pre- to post-intervention, and that athletes from both earlier studies exhibited increases in mindfulness.

Over the past year, a controlled study of the expanded MSPE protocol has been ongoing, using a sample of Division I collegiate long-distance runners (Pineau et al., 2012). Pre-post data have yet to be analyzed, but early results from pre-intervention assessments have revealed that, in addition to the number of miles run per week, the acceptance component of mindfulness significantly predicted running times. This finding further highlights the potential importance of mindfulness to sport performance and the promise of mindfulness training for athletes.

Mindfulness-Acceptance-Commitment (MAC) Approach

Gardner and Moore's (2004, 2007) mindfulness-acceptance-commitment (MAC) approach to performance enhancement is another manualized mindfulness-based intervention developed for and studied using athletes. This approach draws heavily from Acceptance and Commitment Therapy (ACT; Hayes, Strosahl, & Wilson, 1999), and consists of seven weekly meetings, or modules. These modules include in-session exercises and discussions, as well as between-session homework assignments designed both to reinforce the skills being taught in each module and to provide material for discussion in subsequent sessions. A more complete description of the MAC approach (Gardner & Moore, 2007; Moore, 2009; Schwanhausser, 2009), and empirical evidence in support of this intervention can be found elsewhere in this volume (see Gardner & Moore, Chapter __).

Other Mindfulness Interventions for Athletes

In an attempt to explore the impact of mindfulness training on the experience of flow, Aherne, Moran, and Lonsdale (2011) devised a basic 6-week mindfulness intervention for athletes. This training includes a handout that outlines information on mindfulness and how it

can be applied to sport, and instructions for daily, individual home practice doing one of four exercises (two versions of a 10-minute sitting meditation, 10-minute standing yoga, and a 30-minute body scan) from the CD “Guided Meditation Practices” (Williams, Teasdale, Segal, & Kabat-Zinn, 2007). Athletes are also given a scheduled timetable of the home practice and sent daily text message reminders to facilitate their training. No group practice or discussion is involved. In a randomized controlled investigation of this program, Aherne and colleagues (2011) found that athletes who received this training experienced significant increases in mindfulness and flow that were not exhibited by the control group.

Baltzell and Akhtar’s (2012) Mindfulness Meditation Training for Sport (MMTS) is a 6-week program consisting of two 30-minute meetings per week, and integrating mindfulness training with traditional psychological skills training (e.g., imagery and self-talk). The discussions and exercises focus on teaching open awareness, the use of positive affirmations, concentration, and tactics for coping with negative mind-states (e.g., labeling emotions and nonreactivity). In addition to the in-session meditations, participants are encouraged to practice on their own daily. In a quasi-experimental study of this approach, athletes who received MMTS showed a significantly greater increase in mindfulness than controls, while controls reported a significant increase in negative affect that was not evident in the MMTS group (Baltzell & Akhtar, 2012).

Langer’s Mindfulness Approach

Langer has not specifically addressed how her mindfulness approach might impact sport performance, but Pietrasz and Langer (described in Langer, 1997) conducted a study that suggests it could have some benefits for athletes. They taught a group of children a novel sport similar to squash, which they named “smack-it ball.” The experimental manipulation involved

the use of conditional language when presenting the sport's instructions to half of the participants, and absolute language with the other half. It had been shown previously that the presentation of material in a conditional manner (e.g., "one way to hold your hand might be..."), rather than in an absolute manner (e.g., "this is how to hold your hand") leads to what Langer calls mindful learning, which promotes an awareness of multiple perspectives and contextual factors when working with new information (Langer, 1989, 1997). After giving the participants time to practice the new smack-it-ball skills, the researchers secretly exchanged the ball being used for a similar looking but much heavier one, requiring the participants to adapt and use different body movements than the ones they had been taught. As predicted, those participants who had received the absolute instructions were more likely to exhibit performance decrements (i.e., an inability to adapt) than those who had received the conditional instructions.

When Pietrasz and Langer switched the balls they were re-creating a very common phenomenon in most, if not all, sports. Specifically, the environment of competition can be variable and unpredictable, which requires athletes to adjust the well-learned techniques they may have honed in the practice environment. Langer (2000) states that a primary myth believed about learning is that "the basics" need to be so well learned that they become automatic (a belief certainly espoused in sports). However, Langer and Imber (1979) found that such an approach may lead to over-learning, which could result in an individual losing the ability to make small adjustments to "the basics" that are often necessary in dynamic contexts (like sports). Langer's research suggests that this difficulty might be avoided with a simple linguistic change from absolute to conditional instructions that promote the mindful learning of athletic skills.

A significant component of this kind of mindful learning is mental flexibility (Langer, 1989, 1997), which is also a major part of the EM-based performance enhancement interventions

described above. For instance, a foundational concept underlying the MAC program is that “a *flexible* approach to one’s experiences ... is essential for optimal functioning” (Gardner & Moore, 2007, p. 32). In fact, much like Pietrasz and Langer describe the negative impact of mindless learning on performance in their smack-it ball study, Gardner and Moore (2007) explain that rule-governed behavior impairs an individual’s capacity to take in and respond to situational or contextual environmental cues (Hayes, Kohlenberg, & Melancon, 1989), which can then result in actions that may not be ideally suited to the task at hand. They propose that mindfulness may be the antidote to this problem, in that it “enhances the individual’s sensitivity to cues and contingencies in the environment and thus promotes greater behavioral flexibility” (p. 37). Similarly, MSPE emphasizes the importance of nonjudgmental awareness, which helps to promote mental flexibility by allowing athletes to accept the occurrence of both internal (e.g., emotions) and external (e.g., weather) events. Rather than expend mental and physical energy worrying about or wishing away unexpected or uncontrollable circumstances, mindful athletes, as defined by Kaufman and Glass (2006), have more available resources to devote to the task at hand, enhancing their capacity to respond to the situation appropriately.

While both perspectives on mindfulness share an emphasis on engagement with the present moment, a distinction between them is that LM is primarily focused on working with information that is external to the individual (e.g., awareness of the situational context), whereas EM is less goal directed and focuses more on stimuli and processes that are internal to the individual (e.g., awareness of thoughts and feelings; Baer, 2003; Bishop et al., 2004). This is an important distinction, but it may be helpful to view this divergence as a way in which these views actually compliment each other. Although internal factors play an important role in sport performance, all sports are in some way skill-based, requiring the ability to interact with one’s

surroundings. Langer's mindful learning may be a useful bridge between the internal nature of EM and the inherently external nature of the sports to which EM is being applied.

Mindfulness and Flow

Sport psychologists often associate peak-performance experiences, or being “in the zone,” with states of flow (Jackson & Csikszentmihalyi, 1999; Young & Pain, 1999). Flow typically occurs when a person perceives a balance between the challenges associated with a situation and his or her capacity to meet those challenges. While in a flow state, an individual is so involved with the task at hand, and finds the activity so inherently enjoyable, that nothing else seems to matter (Csikszentmihalyi, 1990). Such an experience is generally regarded as an optimal psychological state, as mind and body are in harmony, negative thinking and self-doubt are absent, and functioning is enhanced (Jackson, 2000). For athletes, this state can ultimately result in optimal sport performance (Jackson & Roberts, 1992; Jackson, Thomas, Marsh, & Smethurst, 2001).

Recently, a growing interest in the connection between flow and EM has developed. For example, Gardner and Moore (2004) note some important similarities between flow and mindfulness, pointing out that both constructs “share an emphasis on present-moment, non-self-conscious concentration on a particular task” (p. 714). Empirical research has supported this proposed connection, with numerous studies demonstrating not only a robust relation between measures of mindfulness and flow in athletes (Bernier, Thienot, Codron, & Fournier, 2009; Kaufman et al., 2009; Pineau, Glass, Kaufman, Tenuta, & Bernal, 2011; Pineau et al., 2012), but also significant increases in athletes' levels of flow after receiving mindfulness-based interventions (Aherne et al., 2011; Kaufman et al., 2009).

Given this evidence, some authors suggest that flow may be one of the key paths through which mindfulness training can help athletes improve their performance (Gardner & Moore, 2004; Kaufman et al., 2009). In an attempt to provide a more complete picture of this association, the complex relation between mindfulness and flow will be explored. Almost all research to date looking at mindfulness and flow has used EM measures, but thoughtful consideration is also given below to how LM may relate to flow.

Eastern Mindfulness and Flow

Most descriptions of EM include an awareness component and an acceptance component (Bishop et al., 2004; Cardaciotto, Herbert, Forman, Moitra, & Farrow, 2008). However, Baer and colleagues (Baer, Smith, & Allen, 2004; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006) propose that these aspects can be further broken down into several facets that represent different ways to operationalize awareness and acceptance. These facets of mindfulness (Baer et al., 2006, 2008) include observing (noticing a variety of internal and external stimuli), describing (applying labels to observed phenomena), acting with awareness (being fully engaged in activities as opposed to being on automatic pilot), nonjudging of inner experience (being fully accepting of thoughts and feelings), and nonreactivity to inner experience (allowing thoughts and feelings to come and go without overidentifying with them).

Three studies examining mindfulness and flow using Baer's measures found significant positive associations between mindfulness and flow in athletes (Kaufman et al., 2009; Pineau, Glass, Kaufman, Tenuta et al., 2011; Pineau et al., 2012). However, each of these studies revealed a different constellation of relations between the elements of mindfulness and flow (see Table 1). What these results may suggest is that, while the essence of a nonjudgmental present-moment awareness could be an integral aspect of optimal sport performance in general,

performance in specific sports that require unique skills may benefit differentially from a focus on certain facets of mindfulness.

For example, the acting with awareness component of mindfulness was not related to flow in runners or rowers (Pineau, Glass, Kaufman, & Bernal, 2011; Pineau et al., 2012), but showed the strongest correlation with flow of any of the mindfulness factors in archers and golfers (Kaufman, 2009). Keeping in mind that acting with awareness represents the degree to which individuals do or do not perform tasks on “automatic pilot,” the contrasting demands of these sports may explain this difference. Optimal performance for rowers and runners requires a continuous awareness through the duration of a race while repeatedly performing a single action as efficiently as possible (e.g., a stroke), whereas performance for archers and golfers involves discrete periods of focus throughout a series of unique events (e.g., shooting arrows). Thus, a degree of automaticity in performance may help rowers and runners by freeing up the attentional resources necessary to engage in the continuous awareness of a dynamic external environment.

A similar conclusion may be drawn based on the contrasting results for the acceptance-related aspects of mindfulness between the rowers and runners. The rowers exhibited a significant association between nonjudgmentality and flow, but the runners did not, and the reverse was true for nonreactivity (Pineau, Glass, Kaufman, & Bernal, 2011; Pineau et al., 2012). Since rowing is typically a co-active sport, meaning the combined effort of a group is necessary for performance, an individual rower’s ability to positively impact the boat as a whole with technical changes is limited without the simultaneous effort of the other rowers in the boat. Runners, on the other hand, have more direct control over their performance, as they compete as individuals. It is possible that immediate judgments of one’s performance (e.g., “I am running slower than the person next to me”) may be more beneficial to runners since they could make

effective technical changes when necessary, whereas evaluative thoughts for rowers may provoke feelings of frustration or powerlessness. However, it has been demonstrated that negative performance evaluations can trigger negative self-evaluations (e.g., “I am a slow runner”), which may hurt performance (Klinger, Barta, & Glas, 1981). This may account for the apparent importance of nonjudgmentality for the rowers and nonreactivity for the runners with regard to flow. Thus, it may be useful in future explorations of the relation between mindfulness and flow to avoid drawing sweeping conclusions about all athletes. Alternatively, discussing which components of mindfulness relate to flow for which sports may be more informative, and could contribute to the development of more targeted, sport-specific mindfulness interventions.

Langer’s Mindfulness and Flow

Langer (2002) notes the likely connection between her conceptualization of mindfulness and flow, yet little research has explicitly explored this association. One of the earlier attempts to examine the relation between mindfulness and flow in athletes does provide some evidence for this possible connection. Kee and Wang (2008) defined mindfulness using an Eastern conceptualization (Bishop et al., 2004), but chose to assess the construct using Langer’s Mindfulness/Mindlessness Scale (MMS; Bodner & Langer, 2001), which divides mindfulness into four characteristics: novelty seeking (openness toward new experiences), novelty producing (processing environmental stimuli to generate new and useful information), flexibility (seeing events from more than one perspective), and engagement (noticing details in the environment).

Kee and Wang (2008) found that flow was significantly related to all four of these characteristics. They also found that athletes higher in mindfulness were more likely to adopt mental skills, such as attentional control, emotional control, and goal setting, which were themselves positively related to flow. Although causal connections cannot be drawn from these

correlational data, it is possible that mindful athletes may be more likely to engage in novel strategies that help to promote flow states. In contrast to Kee and Wang's findings, the MMS was not significantly related to flow in a group of collegiate cross-country runners (Pineau et al., 2012), but the small sample size ($n = 23$) may have limited the ability to detect significant results. Given these mixed findings, more research seems warranted on this topic.

Mindfulness and Attention

Attention and Sport Performance

Sport-specific definitions of attention generally consist of four components: selective attention, sustained attention, situational awareness or orienting attention, and attentional flexibility or divided attention (Memmert, 2009; Weinberg & Gould, 2011). When effectively engaging these facets of attention, an athlete is focusing on relevant cues while disregarding irrelevant ones, holding an appropriate level of focus throughout the entirety of a performance, maintaining a constant awareness and understanding of relevant stimuli in the environment, and, when necessary, shifting attention between stimuli or allocating attentional resources to multiple stimuli. Despite the widely accepted importance of attentional processes in sport (Janelle & Hatfield, 2008; Moran, 1996), Boutcher (2008) comments that the literature base on this topic is under-developed, and thus the mechanisms through which attention affects performance is not well understood.

Some of the research on attention in sport performance has found that athletes who engage in "associative" strategies (i.e., directing attention to task-related cues) tend to perform better than those who use "dissociative" strategies (i.e., focusing attention on task-irrelevant cues; Masters & Ogles, 1998; Morgan & Pollock, 1977; Salmon, Hanneman, & Harwood, 2010). However, Hutchinson and Tenenbaum (2007) note that this effect has not been well-established

in sports other than running (see Spink & Longhurst, 1986 for an exception with swimmers), and that this difference has not always been supported even for runners (e.g., Stevinson & Biddle, 1998). Additionally, the dichotomous system of associative versus dissociative attention does not account for the fact that athletes often switch between strategies based on the type or intensity of the task they are completing (Hutchinson & Tenenbaum, 2007; Salmon et al., 2010). Salmon and colleagues (2010) propose that a mindfulness-based conceptual model of attention, with an emphasis on the nonjudgmental awareness of whatever arises in one's present-moment experience, is able to account for this shifting of attentional strategies based on task demands.

Other research focusing on more objective phenomena, including response time, response accuracy, and patterns of visual fixation (e.g., frequency, duration) has found that, in comparison to novice athletes, expert athletes are quicker and more accurate in their physical responses and exhibit fewer, but longer visual fixations (Mann, Williams, Ward, & Janelle, 2007). This suggests that expert athletes may have more efficient attentional processes than their novice counterparts, being able to glean more relevant information from fewer environmental cues, and then react to those cues more quickly and appropriately. Like Salmon et al. (2010), Moore (2009) posits that mindfulness may be important to consider when discussing attention in sport, stating that, "mindfulness practice may very well facilitate the development of this more economical mode of using and allocating cognitive (in particular) attentional resources" (p. 294). In light of these suggestions, the effects of EM training on attentional processes will be explored, as well as how this may influence sport performance. The potential impact of LM on attentional processes will also be discussed, as Langer's focus on the awareness of external stimuli and cognitive flexibility may be particularly relevant in a sport context.

Eastern Mindfulness and Attention

A core feature of EM is the ability to pay attention (Kabat-Zinn, 1994, 2003), and, in fact, research has shown that mindfulness training can improve attentional abilities (e.g., Jha, Krompinger, & Baime, 2007; see Chiesa, Calati, & Serretti, 2011 for a review). In non-athlete populations, mindfulness has been shown to relate to superior selective attention (Chan & Woollacott, 2007; Jensen, Vangkilde, Frokjaer, & Hasselbalch, 2012; van den Hurk, Gionmi, Gielen, Speckens, & Barendregt, 2010), sustained attention (Chambers, Lo, & Allen, 2008; Valentine & Sweet, 1999), situational awareness (Jensen et al., 2012; Moore & Malinowski, 2009), and attentional flexibility (Hodgins & Adair, 2010). It has been suggested that these attentional enhancements may be an important mechanism through which mindfulness training can improve sport performance (Gardner & Moore, 2004; Moore, 2009), but little research has looked specifically at the effects of mindfulness training on the attentional processes of athletes.

Weinberg and Gould (2011) propose that several important dimensions of flow involve high levels of attention and concentration. Thus, the flow research provides some indirect evidence for the connection between mindfulness and attention, as mindfulness has been shown to relate to the merging of action and awareness, concentration on the task at hand and a sense of control, and the processing of unambiguous feedback (Aherne et al., 2011; Kaufman et al., 2009; Pineau, Glass, Kaufman, & Bernal, 2011; Pineau et al., 2012), which have conceptual similarities to selective attention, sustained attention, and situational awareness, respectively.

Additionally, in her case study of a springboard diver, Schwanhausser (2009) provides qualitative data regarding the effects of the MAC approach on sustained and selective attention, as the athlete reported after the intervention that he noticed an increased ability to “stay focused despite distractions” (p. 390). This evidence seems to bolster Gooding and Gardner’s (2009)

conclusion that “the positive performance enhancing qualities inherent in mindfulness may be due to its relationship to the self-regulation of attention” (p. 315).

Salmon and colleagues (2010) propose a mindfulness-based model that includes both awareness and acceptance (e.g., nonreactivity) to explain how certain attentional processes can enhance sport performance. For example, while the enhanced awareness of bodily sensations may give athletes a more accurate perception of their level of physical exertion, it is the nonreactive attitude taken toward those bodily sensations that allows them to more efficiently use their available resources by avoiding the distracting, self-evaluative worries, and subsequent physical consequences that often accompany feelings of fatigue and exhaustion (see the physiology and mindfulness section for additional discussion of this topic). This idea makes sense considering that performance setbacks can cause attentional shifts from task-relevant cues to self-evaluative cues (i.e., being judgmental of oneself), which may result in performance decrements (Klinger et al., 1981), while “detachment” (i.e., nonreactivity) has been cited by elite pentathletes as an important strategy to counteract the debilitating attentional and emotional consequences of making mistakes during sport performance (Bertollo et al., 2009).

Some negative findings have also been found regarding the link between mindfulness and attention, with research demonstrating no difference between meditators and non-meditators on measures of attention (Josefsson & Broberg, 2011), no improvement compared to controls in attentional processes following an 8-week mindfulness intervention (Anderson, Lau, Segal, & Bishop, 2007), and even a significant association between mindfulness and exaggerated lapses in attention (Schmertz, Anderson, & Robins, 2009). Such mixed results may be due to a variety of methodological flaws within the body of research (Jensen et al., 2012), or to the use of varied measures of attention that may relate differently to mindfulness skills (Josefsson & Broberg,

2011). Considering this latter possibility, after finding no differences between meditators and non-meditators on two measures of attention, Josefsson and Broberg (2011) conclude that “mindfulness meditators may have an increased awareness of internal processes and the ability to quickly attend to them but this type of refined attentional ability does not seem to be related to performance on attention tests requiring responses to external targets” (p. 291). This conclusion is quite striking since responding to external targets is precisely what many athletes are required to do. Given the recognition that a primary difference between EM and LM is that the latter focuses more on the awareness of external, rather than internal, stimuli (Baer, 2003; Bishop et al., 2004), it appears that LM could play an important role in the attentional processes of athletes.

Langer’s Mindfulness and Attention

Langer (1997) states that a commonly believed “myth” about attention is that “paying attention means staying focused on one thing at a time” (p. 2). She proposes that this mindset actually inhibits attentional capacity because, in accordance with this belief, one may put excessive amounts of mental energy into trying to maintain focus on a single stimulus from just one perspective. In studying this hypothesis, Langer and her colleagues have consistently found that, for a variety of populations, when people are given instructions to vary their focus of attention in some way, their attentional performance improves (Langer, 2000; Langer & Bayliss, described in Langer, 1997; Levy, Jennings, & Langer, 2001).

Langer has not explicitly examined this idea in a sport context, but she does mention sport as a particularly well-suited atmosphere for the implementation of this kind of varied attention, noting, “in tennis or table tennis or any sport, we move around so that the stimulus is never quite the same” (Langer, 1997, p.42). This notion of the usefulness of varied attention does have some indirect support in the sport psychology literature, as attentional flexibility has

been linked with expert sport performance (Memmert, 2006; Nougier & Rossi, 1999; Pesce & Audiffren, 2011). In one particularly relevant example, Memmert and Furley (2007) found that, when not given a specific task to focus on (e.g., make a specific play), the breadth of athletes' attention seems to broaden and become more flexible, as they search the environment for a variety of optimal tactical opportunities rather than just a limited few, potentially enhancing overall performance. Such broadening of attention may also produce significant increases in creative play in the complex environments of team sports (Memmert, 2007). These results seem to support Langer's proposition that certain mindsets (e.g., "I need to make a specific play") can inhibit one's ability to attend fully to the environment, while other, more mindful mindsets can have the opposite effect.

For athletes, increasing levels of LM could result in a broadening of attention, which might allow them to more quickly notice relevant cues, shift their focus to new cues, and make more creative connections between these cues. This could enhance their ability to solve emergent problems, make effective decisions, and ultimately improve performance. However, more research is needed examining the possible effects of LM on attention in sport, as only one study to date has found a link between this conceptualization of mindfulness and attention in athletes (Kee & Wang, 2008).

Mindfulness and Affect

Affect and Sport Performance

The notion that both positive and negative emotions can impact athletic performance is firmly established in the sport psychology literature (Hanin, 2000; Lazarus, 2000; McCarthy, 2011). Feeling intrinsic enjoyment in sport participation (i.e., autotelic experience) is an integral part of flow (Csikszentmihalyi, 1990; Jackson, 2000; Jackson & Csikszentmihalyi, 1999), and

both anecdotal and empirical evidence suggest that enjoyment of sport participation is a significant factor in sustained successful involvement in athletics (Fitzgerald, 2010; McCarthy & Jones, 2007; Scanlan, Russell, Beals, & Scanlan, 2003). A variety of positive emotions in athletes (e.g., happiness) have also been positively correlated with self-rated performance (Totterdell, 1999; Vast, Young, & Thomas, 2010), improved reaction times (Woodman et al., 2009), and a broadening of attention, leading to more openness, attentional flexibility, and an enhanced capacity to integrate information (Carver, 2003; Fredrickson, 2001). Additionally, hope and optimism may be protective factors against burnout in athletes (Chen, Kee, & Tsai, 2008; Gustafsson, Hassmen, & Podlog, 2010).

Regarding the impact of negative emotions, it appears that high levels of such feelings tend to have detrimental effects on sport performance. For instance, excessive levels of anxiety have been shown to be associated with more muscle tension and fatigue (Pijpers, Oudejans, Holsheimer, & Bakker, 2003), narrowed attentional focus (Landers, Wang, & Courtet, 1985), concentration disruption (Hatzigeorgiadis & Biddle, 2001; Otten, 2009), and an overall decrease in the efficiency of cognitive processing (Wilson, 2008). Increased levels of anxiety, as well as other forms of negative affect (e.g., depressive symptoms), are also characteristics of burnout (Hackney, Perlman, & Nowacki, 1990) and overtraining syndrome (Armstrong & VanHeest, 2002), which are largely defined by worsening performance.

Considering the importance of affect for athletes, the link between emotions and mindfulness will be explored, with a focus on the role of mindfulness in emotion regulation. Also, Langer's (1989, 2002) emphasis on the importance of perspective in determining affective responses will be discussed, as it may serve as an important point of departure from EM, and could have implications for the relation between anxiety and sport performance.

Eastern Mindfulness and Affect

An ample body of literature has demonstrated a robust association between EM and psychological well-being (Greeson, 2009; Keng, Smoski, & Robins, 2011; Orzech, Shapiro, Brown, & McKay, 2009). Evidence with non-athlete populations suggests that mindfulness training can both enhance positive affect (e.g., Anderson et al., 2007; Geschwind, Peeters, Drukker, van Os, & Wichers, 2011; Nyklicek & Kuijpers, 2008) and decrease negative affect (e.g., Chambers et al., 2008; Shapiro, Schwarz, & Bonner, 1998; Zeidan, Johnson, Gordon, & Goolkasian, 2010; see Toneatto & Nguyen, 2007 for contradictory evidence regarding the effects of mindfulness on depression and anxiety).

A smaller literature with athletes supports the association of mindfulness with higher levels of positive affect and lower levels of negative affect. For instance, significant inverse correlations have been found between mindfulness and sport-related anxiety (Pineau, Glass, Kaufman, & Bernal, 2011; Pineau et al., 2012; Thompson, Kaufman, De Petrillo, Glass, & Arnkoff, 2011b), while positive relations have been found between mindfulness and both general optimism (Pineau, Glass, Kaufman, & Bernal, 2011) and sport-related optimism (Kaufman, 2009; Pineau, Glass, Kaufman, & Bernal, 2011; Pineau et al., 2012). Additionally, in response to MAC and MSPE, athletes have been shown to demonstrate significant reductions in aspects of sport-related anxiety (Gardner & Moore, 2004; DePetrillo et al., 2009), and significant increases in sport-related optimism (Kaufman et al., 2009). Moreover, it appears that athletes continue to experience these benefits over time, as Thompson et al. (2011a) found that, 1 year after MSPE workshops, athletes exhibited a significant reduction in sport-related anxiety and reported an increase in general life satisfaction, with several indicating enhanced enjoyment of their sport.

While this ability to directly alter levels of specific emotions may be an important feature of mindfulness for athletes, it is possible that the promotion of emotion regulation may actually produce even greater benefits for sport performance. It has been suggested that enhancing emotion regulation may be a primary mechanism of change in mindfulness interventions (see Gratz & Tull, 2010 for a review), and emotion regulation is an important construct in the sport psychology literature (e.g., M. V. Jones, 2003). For example, an important distinguishing factor between unsuccessful and successful athletes may be their degree of susceptibility to changes in mood in response to situational factors (Coker & Mickle, 2000). Also, Lemyre, Treasure, and Roberts (2006) found that increased variability of negative affect was predictive of burnout.

Gratz and Tull (2010) offer that a useful conceptualization of emotion regulation “may arguably focus on adaptive ways of responding to emotional distress, rather than on the control of emotions or dampening of emotional arousal in general” (p. 111), since research has suggested that efforts to control or avoid internal experiences (e.g., emotions) often have a paradoxical effect, leading these experiences to be more frequent or intense (Hayes, Luoma, Bond, Masuda, & Lillis, 2006; Janelle, 1999; Wegner, 1994). Without discussing emotion regulation directly, both the MAC approach and MSPE describe the ability to resolve this “ironic mental process” (Wegner, 1994) as one of the primary benefits of a mindfulness- and acceptance-based approach over traditional control-oriented psychological skills training for athletes.

Evidence directly linking mindfulness and emotion regulation in athletes is lacking. However, such a connection is indicated by the work of Baltzell and Akhtar (2012), who recently found that athletes who received MMTS showed virtually no change across a variety of dimensions of positive and negative affect over 6 weeks, while a control group exhibited significant fluctuations on 10 different facets of positive and negative affect. Additionally,

athletes who receive mindfulness-based interventions appear to engage in less experiential avoidance and become more accepting of their current emotional experiences, whatever they may be (Gardner & Moore, 2004; Lutkenhouse, Gardner, & Morrow, described in Gardner & Moore, 2007; Schwanhausser, 2009). This is concordant with the conceptualization of EM as a way to cultivate emotional balance (Kabat-Zinn, 1990), and the demonstrated association in non-athletes between mindfulness and emotion regulation (Arch & Craske, 2006; Chambers, Gullone, & Allen, 2009; Hayes & Feldman, 2004). Taken together, this evidence implies that mindfulness interventions may help athletes improve their performance by not only increasing positive emotionality and decreasing negative emotionality, but also by helping them to regulate their reactions to the strong emotions that are inevitably produced by competitive sports.

Langer's Mindfulness and Affect

The accumulated body of research on LM has shown that greater levels of mindfulness are associated with increased feelings of competence, more positive affect, enhanced creativity, and a reduced risk of occupational burnout (Langer, 1989, 1997), all of which could suggest a link between mindfulness and improved sport performance. Indeed, there appears to be some empirical support for this proposed association. For instance, Denny and Steiner (2009) found that in a diverse group of athletes, mindfulness (assessed on the MMS) was positively related to happiness and overall life satisfaction, and negatively related to distress. Mindfulness also significantly predicted life satisfaction, while performance-related factors (e.g., amount of playing time, scholarship status) did not. Additionally, Haigh, Moore, Kashdan, and Fresco (2011) found that the MMS and a measure of emotion regulation were positively correlated in non-athletes, and Kee and Wang (2008) found that the MMS was significantly related to emotional control in athletes. These findings support a potential relationship between LM and

emotion regulation, which, as noted above, may be important for superior sport performance (M. V. Jones, 2003).

Along with this empirical evidence, there are theoretical arguments to explain how LM may influence the emotional experience of athletes, and thus impact sport performance. Langer (2002) points out that everything individuals evaluate as negative can be seen as positive from a different perspective, and vice versa. The process of seeing this duality (i.e., being mindful) gives people a greater sense of control over their experience of the world. Thus, Langer (1997, 2002) suggests that one should actively seek out a variety of judgments or evaluations to create the possibility of changing one's perspective on any given situation from negative to positive.

Langer has documented the power of perspective, showing that when the same activity is presented as “play” or “work,” people with the “play” perspective enjoyed the experience more and were more engaged than those doing “work” (Snow & Langer, described in Langer, 1997). This importance of perspective may relate to the concept of entrapment theory in the sport psychology literature, which suggests that athletes who feel like they have to participate in their sport or who have low levels of self-determined motivation are at greater risk for burnout than those who feel like they participate because they want to or who have high levels of self-determined motivation (Lonsdale, Hodge, & Rose, 2009; Raedeke, 1997).

Langer's ideas on perspective also fit nicely with G. Jones' (1995) theory of facilitative and debilitating anxiety, which asserts that how an athlete interprets feelings of anxiety in large part determines the effect of that anxiety as helpful or harmful. According to Langer's view, in actively searching for these multiple interpretations of anxiety, athletes give themselves a choice to perceive, and to be affected by, the more beneficial interpretation in that moment. This aspect of choice is particularly relevant given Jones' emphasis on the perception of control in

determining whether anxiety will be experienced as facilitative or debilitating. Langer (1989) writes that, “[e]ven the most apparently fixed and certain situations can become subject to control if viewed mindfully” (p. 74). In contrast, EM encourages the “letting go” of any judgment, positive or negative, (Kabat-Zinn, 1990), and so an EM approach would guide athletes to nonjudgmentally observe their anxiety as a feeling that is not necessarily representative of reality (i.e., neither facilitative nor debilitating). This may neutralize the potentially negative effects of anxiety, but it could remove facilitative effects as well.

It seems that LM may play an important and distinct role in the association between affect and sport performance. However, when the theoretical and empirical evidence connecting affect to both concepts of mindfulness is considered, there appears to be support for the conclusion that EM and LM may compliment each other such that interventions designed to incorporate both views might be more beneficial than either approach alone.

Mindfulness and Physiology

Sport is an inherently physical pursuit, and sport psychologists have endeavored to understand the physiological correlates and determinants of optimal athletic performance. In particular, emerging neuroimaging technologies have allowed researchers to examine the neurological underpinnings of superior performance in sport (e.g., Hatfield & Kerick, 2007). Such technologies have also created the opportunity to explore the neurological correlates of mindfulness (Siegel, 2007; Treadway & Lazar, 2010). The neurological factors that have been found to be associated with both mindfulness and sport performance will be reviewed, with a particular focus on research relating EM, neurological processes, and the perception of pain and fatigue. Langer’s mindfulness will also be addressed, as some literature suggests training in LM can have similar effects on physiological process (e.g., blood pressure) as meditation (Alexander,

Langer, Newman, Chandler, & Davies, 1989). Additionally, the openness to new ideas and perspectives that is characteristic of LM may be an important prerequisite for mindfulness-based interventions to produce physiological effects, and may also alter the impact of pain and fatigue.

Eastern Mindfulness and Physiology

A number of physiological effects relevant to sport performance have been shown in response to mindfulness-based interventions (e.g., decreased pre-competitive cortisol production indicating reduced pre-competitive stress, John, Verma, & Khanna, 2011), but one of the more potentially intriguing associations between mindfulness and physiological processes with relevance for sport performance has to do with the experience of pain. Early research on MBSR involving chronic pain patients demonstrated that mindfulness training can decrease perceptions of pain intensity, emotional reactivity to pain, and the use of pain-relieving drugs, and that some of these benefits are maintained up to 4 years later (Kabat-Zinn, 1982; Kabat-Zinn et al., 1985; Kabat-Zinn et al., 1987). More recent controlled studies of mindfulness-based interventions using healthy participants also found decreases in pain sensitivity (Kingston, Chadwick, Meron, & Skinner, 2007; Zeidan, Gordon, Merchant, & Goolkasian, 2010), providing further support for mindfulness as an effective way to enhance one's pain tolerance. This relation between mindfulness and coping with pain seems potentially meaningful for athletes, since many sports involve pushing the body toward its maximum physical capacity, which is often a painful experience.

Most sport and exercise scientists assume that fatigue and exhaustion in sport, which are often accompanied by muscle pain, are the result of purely physiological phenomena (Noakes, St. Claire Gibson, & Lambert, 2005). However, it has been observed that the *perception* of effort while performing may predict exhaustion better than any physiological measure does

(Noakes, 2008), and as such, “exercise tolerance in highly motivated subjects is ultimately limited by perception of effort” (Marcora & Staiano, 2010, p. 763). Considering this possible key role of perception in the reaction to and effects of physical pain during sport performance, Kaufman et al. (2012) argue that an enhanced ability to cope with pain might be one of the principal ways that mindfulness training could benefit athletes who participate in sports in which pain is often experienced as a limiting factor of performance.

This potential advantage for mindful athletes is highlighted by the work of Grant and Rainville (2009), who found that not only did meditators have a generally higher pain threshold than controls, but also, when they were asked to pay mindful attention to a painful stimulus, controls reported an increase in pain sensitivity while meditators showed a slight decrease. This finding seems particularly meaningful given the research of Hutchinson and Tenenbaum (2007), who found that attentional focus during physical activity is mediated by the intensity of the task, such that, “during high intensity exercise attention is focused on overwhelming physiological sensations, which dominate focal awareness” (p. 244). These studies seem to suggest that athletes engaging in physically demanding sports that result in muscle pain would necessarily have their attention drawn to that pain, resulting in increased pain sensitivity for those with no mindfulness training, but decreased pain sensitivity for experienced meditators. In light of the apparent importance of the perception of effort, which, for many athletes, includes the interpretation of muscle pain as an indication of physical exhaustion (Marcora & Staiano, 2010; Noakes, 2008), the potential implications for performance are clear: more mindful athletes may perceive a sport as less painful, thus allowing them to use more of their available physiological resources to outperform less mindful competitors.

Some authors propose that underlying this enhanced capacity of mindfulness practitioners to tolerate pain are actually a variety of structural (e.g., Grant, Coutemanche, Duerden, Duncan, & Rainville, 2010) and functional (e.g., Zeidan et al., 2011) neurological adaptations. Specifically, meditation appears to be related to cortical thickening of brain areas typically associated with attention, such as the right anterior insula (Hölzel et al., 2008; Lazar et al., 2005), anterior cingulate cortex (Grant et al., 2010), and prefrontal cortex (Lazar et al., 2005). This observed effect in the anterior cingulate cortex also indicates a link between mindfulness and emotion regulation, while the cortical thickening of the right anterior insula, as well as the sensory cortex (Grant et al., 2010), demonstrates a connection between mindfulness and brain regions involved in awareness of bodily sensations (i.e., interoceptive awareness). Increased cerebral blood flow has also been found in several of these regions (anterior insula, anterior cingulate cortex, and orbitofrontal cortex) in response to painful stimuli following mindfulness meditation (Zeidan et al., 2011). As attention, emotion regulation, and interoceptive awareness are all involved in the perception of pain, this evidence provides support for the hypothesis that neuroplastic changes may account for the altered pain sensitivity of meditators.

This evidence may also warrant an even broader conclusion. Namely, mindfulness practice may produce most, or even all of its benefits (e.g., improved emotion regulation and attentional capacity) through the promotion of neuroplasticity, or the brain's ability to adapt, both structurally and functionally, in response to a repeated task (Davidson, 2002; Siegel, 2007). [See Treadway & Lazar (2010) for a review of EM and neuroplasticity; see Marks (2008) for a review of the neural correlates of EM in relation to sport performance.] For instance, following an 8-week MBSR course, individuals exhibited a pattern of increased activation of left-sided anterior brain regions, which is associated with reduced negative affect, increased positive affect,

and enhanced emotion regulation (Davidson et al., 2003). Similarly, fMRI studies have found that, compared to those with little or no meditation experience, experienced meditators tend to show greater activation of the medial prefrontal cortex during meditation (Hölzel et al., 2007), and greater activation of insula and cingulate cortices in response to emotional stimuli (Lutz, Brefczynski-Lewis, Johnstone, & Davidson, 2008), which are all brain regions known to be involved in emotional processing. Regarding attention, EEG research has shown a link between decreased brain activity and superior attentional capacity following 3 months of intensive meditation training (Slagter et al., 2007), which suggests that mindfulness practice may improve attention by increasing the efficiency of the allocation of neural resources for attention-related processes.

Given the importance of positive affect to peak performance experiences (Jackson, 2000; Jackson, & Csikszentmihalyi, 1999), and the integral role of emotion regulation (M. V. Jones, 2003) and attention (Moran, 1996) in superior sport performance, this collective evidence supports the conclusion that the neuroplastic effects of mindfulness training could produce beneficial effects for a wide variety of sports, and not just those in which performance is limited by muscle pain. In fact, when discussing the potential effects of mindfulness on the brain, Marks (2008) posits that, taken in sum, the neural correlates research suggests that mindfulness training is related to “significant enhancements in areas that facilitate attentional control, emotion-regulation, and the perception of others’ actions and intentions—skills that allow for effective athletic training and make peak performance possible” (p. 220).

Langer’s Mindfulness and Physiology

Langer and her colleagues have consistently demonstrated the potential impact of one’s mindset on a variety of phenomena, including physiology, athletics, and exercise. For instance,

Alexander and colleagues (1989) compared meditation, LM training, and relaxation training in an elderly population, and found that the individuals in the meditation and LM conditions had lower blood pressure than the relaxation group 3 months after the training, as well as better survival rates 3 years after the training. Langer, Djikic, Pirson, Madenci, and Donohue (2010) found that, when primed with the mindset that athletes have better vision than non-athletes, participating in an athletic activity improved visual acuity. Crum and Langer (2007) designed a study to examine whether a mindless or mindful mindset could impact the physiological effects of exercise. They evaluated a sample of people engaged in an occupation (cleaning) classified by the Surgeon General as moderate physical activity likely to produce health benefits (Centers for Disease Control and Prevention, 1996). Despite the fact that participants were getting daily exercise through their work, when they were first asked whether they exercised regularly, two-thirds of the sample said no. To help promote a mindful perspective on their daily activities, half of the participants were then informed that their occupation could be considered both work and exercise, while the other half were not.

After 4 weeks, while the actual eating and exercise behaviors of the group as a whole did not change, the people who were given a new way to view their work (i.e., as exercise) not only reported increases in their perceived amount of exercise, but also showed decreases in weight, blood pressure, body fat, waist-to-hip ratio, and body mass index when compared to the control group. These results suggest that mindfulness, specifically the capacity to be flexible in one's mindset when novel information is presented, may be necessary for individuals to experience the added potential benefits of activities about which they already have preconceived beliefs. This could be particularly important with regard to mindfulness-based interventions for sport

performance enhancement, as openness to the idea that an unfamiliar approach to mental training could improve performance may be integral in allowing the training to produce its effects.

Additionally, like EM, LM may have important implications for sport performance through its potential effects on the perception of pain. Specifically, the emphasis on contextual reframing (Langer, 1989) aligns well with the work of Noakes and colleagues (2005; Noakes, 2008), who theorize that muscle pain and fatigue are not purely physical phenomena, and are more correctly conceptualized as sensations that can be unattached to a specific physical manifestation (e.g., performance decrements). When athletes believe that feeling fatigued necessarily impacts their physical ability, this belief can become reality and they may reduce their effort simply because they assume they must (Fitzgerald, 2010). However, if athletes can take on a new perspective and recognize that the feeling of fatigue is just that, a feeling, sensation, or mental event, that has no more of a direct connection to their physical limits than any other thought or emotion, then they could potentially gain the capacity to outperform equally talented competitors who mindlessly believe in the physical nature of fatigue. In sum, this may be yet another important point of integration between the two concepts of mindfulness, as athletes may first need an open and flexible mindset for mindfulness training to produce the level of physiological or psychological benefits discussed in this chapter.

Conclusions and Future Directions

Controlled research on mindfulness-based interventions for athletes using objective assessment of sport performance is just beginning to emerge (John et al., 2011; Pineau et al., 2012). However, controlled research indicating improvements in self- and coach-rated performance (Lutkenhouse et al., described in Gardner & Moore, 2007; Wolanin & Schwanhausser, 2010) and uncontrolled research and case studies showing significant effects on

self-reported performance and important performance-related psychological variables (DePetrillo et al., 2009; Kabat-Zinn et al., 1985; Kaufman et al., 2009; Lutkenhouse, 2007; Schwanhausser, 2009; Thompson et al., 2011a) provide significant support for the potential effectiveness of mindfulness training for sport performance enhancement.

Although the existing literature on mindfulness in athletes is predominantly from the EM perspective, this chapter proposes that there is strong theoretical support for the utility of LM in performance-enhancing interventions in at least two important ways. First, evidence seems to indicate that the openness to novelty that is characteristic of LM could play a crucial role in enhancing the potential effectiveness of EM interventions. Specifically, it has been observed that athletes who tend to conceptualize training as a physical pursuit rather than a mental one may exhibit resistance to dedicating time to unfamiliar training methods that do not provide the same immediate, tangible effects (e.g., muscle soreness) that are often experienced in physical training (A. Baltzell, personal communication, March 23, 2012; Pineau et al., 2012). Interestingly, Stanley, Schaldach, Kiyonaga, and Jha (2011), who discuss the possible resistance to mindfulness training that may be found in groups similar to athletic teams, found that levels of LM significantly predicted the amount of time participants spent meditating over an 8-week mindfulness training, while time spent meditating was positively related to changes in EM. This study was not in a sport context, but it could nonetheless be relevant for athletes. The results suggest that the open-mindedness associated with LM may attenuate potential resistance to an EM approach to performance enhancement, thus making athletes more likely to practice the relevant mindfulness skills, and ultimately benefit from the training.

The second way in which LM may compliment EM is through LM's focus on the awareness of external stimuli. The foundational EM skills of awareness and acceptance, which

are generally internally oriented (Baer, 2003; Bishop et al., 2004), may provide a variety of benefits for athletes with regard to their cognitive, emotional, and physiological processes. However, incorporating aspects of LM (e.g., cognitive flexibility and awareness of external contexts) in EM interventions may help athletes develop the capacity to apply EM skills, which are generally practiced in sedentary ways, to novel, dynamic situations in daily life (e.g., sport).

MSPE has attempted to address this application issue by prescribing a progression of meditations that evolve from sedentary to active. However, incorporating aspects of LM into future versions of MSPE might facilitate this process even further (e.g., including didactic components in group discussions that explicitly address concepts integral to LM, and ensuring that conditional, rather than absolute phrasing, is used when introducing mindfulness exercises). This could improve athletes' ability to apply the mindfulness skills they develop in specific situations during the workshop (e.g., laying on the ground to do a body scan in a quiet room) to a variety of new contexts in which they have not previously practiced (e.g., waiting for the start of a race in a crowded stadium).

The evidence appears to suggest a complimentary association between the two conceptualizations of mindfulness in relation to sport performance. Considering the potential benefit of including LM in EM-based sport performance enhancement interventions, an important future direction for research could be examining the effectiveness of such an integrative approach. Additional research on the neurological correlates of both perspectives is also needed. While a growing body of literature contends that many of the psychological effects of EM training observed in athletes may be attributable to neuroplastic changes, the potential neurological correlates of LM remain unknown. Neuroimaging research would contribute to a better understanding of the mechanisms of LM, and could elucidate how the two views of

mindfulness overlap with, differ from, or complement each other with regard to the brain processes that likely govern how mindful attitudes are outwardly expressed. Finally, more research on the efficacy of current EM interventions for athletes, such as MSPE and the MAC approach, is also needed. In particular, studies using objective assessments of performance and randomized comparisons of mindfulness-based and traditional sport psychology interventions are a necessary next step to build on the emerging evidence demonstrating the performance-enhancing effects of mindfulness training for athletes.

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Table 1
Correlations Among Flow and Mindfulness Subscales for Three Groups of Athletes

	Mindfulness Total	Observe	Describe	Act with Awareness	Nonjudge	Nonreact
Kaufman (2009): Archer and Golfers ($n = 32$)						
Flow	.79***	.23	.50**	.74***	.60***	No Data
Pineau, Glass, Kaufman, & Bernal (2011): Rowers ($n = 42$)						
Flow	.36*	.12	.33*	.12	.34*	.12
Pineau et al. (2012): Cross-Country Runners ($n = 55$)						
Flow	.41**	.42***	.18	.10	.11	.46***

Note. Kaufman (2009) used the KIMS, a 4-factor measure of mindfulness that did not include nonreactivity.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Appendix A
Summary Outline of the Expanded MSPE Treatment Protocol

- I. Session 1 (approximately 90 min)
 - A. Orientation and rationale
 - 1. Concept of the workshop
 - 2. Rationale for the workshop
 - 3. Important definitions associated with mindfulness training
 - 4. Review of key mental factors in the sport of focus
 - B. Group introductions
 - C. Candy Exercise and discussion (20 min)
 - D. Introductory Sitting Meditation with a focus on the breath (10 min) and discussion
 - E. Discussion of home practice for the week, which includes:
 - 1. Sitting Meditation practice 6 times for 10 min each before Session 2
 - F. Session 1 summary and discussion

- II. Session 2 (approximately 90 min)
 - A. Discussion of home practice
 - B. Discussion of applications of meditation training to the sport of focus
 - C. Body Scan Meditation (30 min) and discussion
 - D. Sitting Meditation with a focus on the breath (10 min) and discussion
 - E. Discussion of home practice for the week, which includes:
 - 1. Body Scan practice 1 time for 30 min before Session 3
 - 2. Sitting Meditation practice 5 times for 10 min each before Session 3
 - F. Session 2 summary and discussion

- III. Session 3 (approximately 90 min)
 - A. Discussion of home practice
 - B. Mindful Yoga practice (40 min) and discussion
 - C. Sitting Meditation with a focus on breath, and body (15 min) and discussion
 - D. Discussion of home practice for the week, which includes:
 - 1. Body Scan practice 1 time for 30 min before Session 4
 - 2. Mindful Yoga practice 1 time for 40 min before Session 4
 - 3. Sitting Meditation practice 4 times for 15 min before Session 4
 - E. Session 3 summary and discussion

- IV. Session 4 (approximately 90 min)
 - A. Discussion of home practice
 - B. Mindful Yoga practice (40 min) and discussion
 - C. Walking Meditation (10 min) and discussion
 - D. Brief sitting meditation with a focus on diaphragmatic breathing (3 min)
 - E. Discussion of home practice for the week, which includes:
 - 1. Body Scan practice 1 time for 30 min before Session 5
 - 2. Mindful Yoga practice 2 times for 40 min before Session 5
 - 3. Walking Meditation practice 3 times for 10 min before Session 5
 - F. Session 4 summary and discussion

V. Session 5 (approximately 90 min)

- A. Discussion of home practice
- B. Sitting Meditation with a focus on breath, body, and sound (23 min) and discussion
- C. Walking Meditation (10 min) and discussion
- D. Sport-Specific Meditation (13 min) and discussion
- E. Brief sitting meditation with a focus on diaphragmatic breathing (3 min)
- F. Discussion of home practice for the week, which includes:
 - 1. Sitting Meditation Practice 3 times for 23 min before Session 6
 - 2. Walking Meditation practice 1 time for 10 min before Session 6
 - 3. Sport-Specific Meditation practice 2 times for 13 min before Session 6
- G. Session 5 summary and discussion

VI. Session 6 (approximately 90 min)

- A. Discussion of home practice
- B. Sport-Specific Meditation (13 min) and discussion
- C. Body Scan practice (30 min) and discussion
- D. Brief sitting meditation with a focus on diaphragmatic breathing (3 min)
- E. Workshop conclusion and discussion of continued practice
 - 1. Review strategies for continued practice
 - 2. Discussion of continued home practice, which includes:
 - a. Mindfulness practice 6 times per week for 30 min per day