Anxiety, Stress, & Coping, 2013
http://dx.doi.org/10.1080/10615806.2012.757306

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The role of athletes' pain-related anxiety in pain-related attentional processes

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(*Received 17 February 2012; final version received 6 December 2012*)

Numerous researchers have highlighted the social determinants of athletes' attitude toward pain, yet little is known about the role of cognitive processes and emotions that are related to pain in sport endeavors. There is evidence, in a dot probe paradigm, that individuals with chronic pain selectively orient their attention toward pain-related stimuli, but no studies have differentiated between the two attentional processes of hypervigilance that are evident in athletes: *facilitated detection of threat* and *difficulty in disengaging attention from threatening stimuli*. In the present study using a dot probe paradigm, we examined whether professional rugby players ($N = 58$) with high pain-related anxiety (HPA) would show an attentional bias for pain-related threat, and whether this hypervigilance would reflect difficulty disengaging from threat or facilitated detection of threat. Rugby players with HPA oriented their attention toward pain-related threat with a concomitant difficulty disengaging from threat. Difficulty disengaging from painful stimuli may increase anxiety, and thus be maladaptive in sport. This is the first study to identify pain-related anxiety as a vulnerability marker in athletes' attentional biases.

Keywords: pain; selective attention; facilitated detection; difficulty disengaging; anxiety

Pain is often associated with the athletic experience and serves the adaptive functions of warning of impending or actual injury and of signaling the achievement of optimum workload to produce a physical conditioning effect (Caine & Lindner, 1990). Athletes are able to withstand more pain than non athletes (e.g., Sullivan, Tripp, Rogers, & Stanish, 2000) and studies of elite and professional athletes have pointed to a willingness to continue training and competing even when injured and in pain (Liston, Reacher, Smith, & Waddington, 2006). Young, White, and McTeer (1994) explained this attitude by the tendency of athletes to deny the existence of pain, and to search for official recognition from significant others. The recognition serves to legitimize *playing hurt* and to rationalize the health risks associated with this attitude (Liston et al., 2006). Nixon (1992) argued that elite and professional sports are characterized by a culture of risk, especially in contact sports such as

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rugby that involve a high risk of injury. Although research has highlighted how social determinants and sport networks can influence athletes' attitude toward pain, few studies have explored the psychological determinants of athletes' response to pain (Deroche, Woodman, Stephan, Brewer, & Le Scanff, 2011) or indeed the cognitive processes involved in attention toward pain.

Researchers agree that pain interrupts current activity, demands attention, and generally interferes with a range of cognitive processes (interpretation, memory, and attention; Pincus & Morley, 2001). The selection of pain over other demands is a normal, adaptive process and is now well documented in individuals suffering from chronic pain as well as in healthy individuals. Indeed, pain is considered a signal of danger, which allows one to initiate a prompt response to the perceived source of threat and to avoid further bodily harm. Moreover, pain involves a complex range of emotions including anxiety, depression, fear, frustration, and anger, which are associated with different cognitive biases (Price, 1999). For example, anxiety is associated with an attentional bias (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJzendoorn, 2007) and depressed mood is associated with both a memory bias and an attentional bias (Gotlib & Joormann, 2010). According to the fear-avoidance model (Vlaeyen & Linton, 2000), in the presence of an injury, people who are fearful of pain show a hypervigilance toward pain. This hypervigilance leads fearful people to initiate a cycle of inactivity that contributes to long-term disability and, paradoxically, pain (Schoth, Nunes, & Liossi, 2012). There is now considerable evidence for attentional biases toward pain-related threatening information in anxious individuals (Bar-Haim et al., 2007; Crombez, Van Damme, & Eccleston, 2005; Pincus & Morley, 2001). Furthermore, individuals with chronic pain detect pain-related stimuli faster than social or general threatening stimuli because they show a *hypervigilance* for pain-congruent information (Bar-Haim et al., 2007; Crombez et al., 2005).

The hypervigilance for pain-congruent information can reflect two attentional processes: facilitated ability to detect threatening stimuli (e.g., facilitated detection of threat) or difficulty in disengaging attention away from threatening stimuli (Bardel, Woodman, Colombel, & Le Scanff, 2012; Cisler, Bacon, & Williams, 2009; Koster, Crombez, Verschuere, & De Houwer, 2004). The *facilitated detection of threat* reflects attention that is oriented more quickly and easily in the direction of threat stimuli compared to other stimuli; conversely, *difficulty disengaging from threatening stimuli* reflects a difficulty diverting attention toward another stimulus once attention has been allocated toward a particular threat stimulus. Few studies have differentiated between these two attentional processes in healthy persons (Carleton, Asmundson, Collimore, & Ellwanger, 2006; Van Damme, Crombez, & Eccleston, 2004; Van Damme, Crombez, Eccleston, & Koster, 2006). Van Damme et al. (2006) showed that people have both facilitated detection of threat and difficulty disengaging from pain-related stimuli. In a study of chronic pain and healthy participants, Carleton et al. (2006) found that participants showed only difficulty disengaging from affective pain. Moreover, recent research has suggested that if the facilitated detection of threat may be an adaptive attentional process (e.g., Vlaeyen & Linton, 2006), difficulty disengaging from painful stimuli may be more maladaptive than adaptive (e.g., Lautenbacher et al., 2010; Sharpe, Dear, & Schrieber, 2009). According to Van Damme et al. (2004) and Lautenbacher et al. (2010), sustained difficulty disengaging attention from pain may be an important factor in maintaining pain and injury, and

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may serve to increase anxiety (Cisler et al., 2009). Recent research has also shown that changes in attentional biases (i.e., a decrease in vigilance attentional bias) can decrease the symptomatology of anxiety disorder and self-reported pain (e.g., Carleton, Richter, & Asmundson, 2011). These results support the contention that attentional biases may be associated with problems in the development and maintenance of pain.

The inability to disengage from pain may result in avoidance behavior (Asmundson, Kuperos, & Norton, 1997), worry (Aldrich, Eccleston, & Crombez, 2000), emotional distress (McCracken, 1997), or overestimation of pain, all of which may contribute to long-term disability (Schoth et al., 2012). Despite the fact that the attentional orientation toward pain can be adaptive in acute sport scenarios (because it signals that the body is in danger of malfunctioning and sustaining long-term damage), a difficulty disengaging attention can be maladaptive in chronic sport scenarios. This is because sports, and especially full contact sports such as rugby, almost universally involve pain. As such, chronic attention to pain-related cues in sport is likely maladaptive in that it serves to distract the athlete from the task at hand, and paradoxically increases the chance of injury via such distraction. This in turn can have implications for both health and performance. For example, a long-term disability would preclude athletes from competition and would thus impede or even stop their sporting careers. The evidence suggests that attentional bias toward threatening information such as pain may be taken as an important vulnerability marker in athletes who are in pain and/or injured (Bar-Haim et al., 2007). However, no research to date has identified the nature of attentional factors involved in the development of such vulnerability markers in athletes (i.e., attentional bias for pain-related stimuli).

In order to facilitate the management of injury and pain, the study of the emotional factors that underlie maladaptive attentional patterns (e.g., difficulty disengaging attention from pain) is important. Among such emotional factors, pain-related anxiety is likely central. This is because pain itself does not cause attentional bias; rather, it is the accompanying psychological factors (e.g., anxiety) that produce interference and serve to maintain or exacerbate pain (Pincus & Morley, 2001; Van Damme et al., 2004). The primary aim of this study is thus to evaluate the effect of pain-related anxiety on attentional processes in professional athletes for whom pain is part of daily activity. We hypothesized that pain-related anxiety would be associated with an attentional bias only toward pain-related threatening information. We further hypothesized that the hypervigilance to pain-related threat would reflect difficulty disengaging from threat and not facilitated detection of threat.

Method

Participants and selection criteria

The study was conducted at the French Rugby Centre in Marcoussis. Professional injury-free rugbymen ($N = 58$, age 17–26 years, $M_{age} = 18.28$ years, $SD = 1.78$) participated in the study. We performed a quartile split on participants' Pain Anxiety Symptoms Scale (PASS; McCracken, Zayfert, & Gross, 1992) scores and retained only the first and fourth quartile. The final sample comprised 30 participants ($M_{age} = 19.00$, $SD = 2.81$): one group with High Pain-related Anxiety

(HPA; $n = 15$; $M_{\text{Anxiety}} = 90.82$, $SD = 12.21$) and one group with Low Pain-related Anxiety (LPA $n = 15$; $M_{\text{Anxiety}} = 34.20$, $SD = 9.77$). The study received ethical approval from the research institution and from the medical staff at the Rugby Centre.

Measures and procedure

Upon arrival, participants were seated in a quiet room before being asked to complete questionnaires on trait anxiety, depression, and pain-related anxiety. Participants then completed the modified dot probe task. All participants were tested individually and were fully debriefed at the end of the task.

Pain-related anxiety

The French version of PASS (McCracken et al., 1992) comprises 40 items that evaluate four components of pain-specific anxiety: cognitive anxiety, fear of pain, escape/avoidance behaviors, and physiological symptoms of anxiety. Each item is rated on a six-point Likert scale from 0 (*never*) to 5 (*always*) and ratings are summed to give a total pain-related anxiety score. The PASS has been shown to have good factor structure, reliability, and validity for clinical (Asmundson & Larsen, 2000) and non-clinical samples (Abrams, Carleton, & Asmundson, 2007). The alpha coefficient in the present study was .90. According to Abrams et al. (2007), pain-related anxiety is considered high when scores are above 80.

The dot probe detection task

We used the modified version of the dot probe detection task (Keogh, Dillon, Georgiou, & Hunt, 2001). Each trial started with a cross-centered on the screen that was presented for 500 ms. Two words was then displayed above each other in upper-case letters for 500 ms. After the offset of the two words, a dot probe replaced one of the words. A Stimulus Onset Asynchrony (SOA) of 500 ms was chosen in accordance with the majority of dot probe studies.

Participants were asked to locate the probe by pressing the appropriate key on the keyboard. There were 15 practice trials followed by 60 experimental trials. For each trial, the response time (RT) was recorded. The physical positions of the stimuli and the probe were counterbalanced across trials. Finally, to control for an order effect, the order of probe and cue presentation was randomized.

A list of 120 words was selected from previous research (Keogh, Dillon et al., 2001; Keogh, Ellery, Hunt, & Hannent, 2001): 20 Pain-related threat words (PT; e.g., *painful, hurt),* 20 Social-related threat words (ST; e.g., *ashamed, ridicule*), and 80 Neutral words (N; e.g., *car, school*). The pain-related stimuli included words related to sensory (e.g., *stabbing*) and affective (e.g., *sickening*) components of pain. We selected words with a high frequency of use in the French language (see Radeaux, Mousty, & Content, 1990). Three types of stimulus pairs were created: N-N, ST-N, and PT-N word pairs. Words were matched as a function of the number of letters and their frequency of use in the French language. For the practice trials, 30 non-threatening words were used.

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Preparation of data

Preparation of response time data

RTs from incorrect trials (.94% of trials) were discarded from the analyses. RTs < 200 and > 1200 ms were discarded on the basis that they reflect anticipatory responding and delayed responding, respectively. Furthermore, RTs that deviated by more than 2 *SD*s from the individual mean RT were considered outliers and removed (1.75% of trials).

Attentional bias scores (ABS)

ABS were based on the standard equation (Mogg, Mathews, Bird, & Macgregor-Morris, 1990), [(NuP1 + N1Pu)-(NuPu + N1P1)]/2, where N = threatening word, P = probe, u = upper position, 1 = lower position (e.g., NuP1 represents the mean RT when the threatening word is in the upper position and the probe is in the lower position). Pain-related and social-related ABS are calculated for each individual's pain ABS and social ABS, respectively. Positive scores reflect vigilance toward threatening words, and negative scores reflect avoidance from threatening words.

Indexes of facilitated detection and difficulty disengaging attention

Indexes of facilitated detection and difficulty disengaging attention were calculated from Koster et al.'s (2004) following equations: facilitated detection index = dN,N – dT,N (dN,N is the mean RT for dots replacing neutral words in the presence of other neutral words and dT,N is the mean RT for dots replacing threat words in the presence of neutral words) and difficulty disengaging index = dN,T – dN,N (dN,T is the mean RT for dots replacing neutral words in the presence of threat words). A positive score on the index of facilitated detection of threat indicates that attention is drawn to the location of threat stimuli more quickly and easily than to other stimuli. A positive score on the difficulty disengaging index indicates difficulty in diverting attention to another stimulus once attention is allocated toward a threat stimulus.

Design and analysis

In order to determine the effect of pain-related anxiety and type of threat word on attentional biases, we conducted a 2 (Pain-related anxiety Group: high, low) $\times$ 2 (Type of Threat Word: pain words, social words) ANOVA with repeated measures on the second factor. The dependent variable was attentional bias score. Independent *t*-tests were used to compare the pain-related anxiety groups on indexes of facilitated detection of threat and difficulty disengaging for pain-related threat words. The assumptions of normality (Kolmogorov–Smirnov's test) and homogeneity of variance (Levene's test) were satisfied throughout.

Results

The means and standard deviations of pain-related anxiety, ABS and facilitated detection–difficulty disengaging indexes for each group are presented in Table 1.

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Table 1. Means of pain-related anxiety, attentional bias scores (ABS), and facilitated detection – difficulty disengaging indexes (standard deviations in parentheses).

	HPA $n=15$	LPA $n=15$
PASS	90.82 (12.21)	34.20 (9.77)
ABS		
Pain-related stimuli	19.79 (28.81)	−5.41 (35.32)
Social-related stimuli	−18.31 (24.39)	−8.09 (41.78)
Index of facilitated detection		
Pain-related stimuli	−2.79 (44.23)	−21.05 (55.97)
Social-related stimuli	−23.41 (29.98)	5.49 (43.04)
Difficulty disengaging index		
Pain-related stimuli	30.86 (30.92)	−3.98 (30.47)
Social-related stimuli	5.14 (35.84)	−15.21 (28.68)

Note: Range of PASS = 0–200.

There was no significant age difference between the groups ($M_{\text{HPA}} = 18.91$ years, $SD = 2.88$; $M_{\text{LPA}} = 19.10$ years; $SD = 2.81$), $F(1, 28) = .24$, $p = .88$.

Effects of type of threat and pain-related anxiety on attentional processes

The repeated measures ANOVA revealed a significant main effect for Type of Threat, $F(1, 28) = 4.50$, $p < .05$, $R^2 = .14$. Individuals oriented their attention toward pain-related threat words ($M = 7.19$) and avoided social threat words ($M = -13.20$). No main effect of pain-related anxiety group was revealed, $F(1, 28) = .49$, $p = .49$.

The interaction between Pain-related anxiety group and Type of Threat Word approached conventional significance, $F(1, 28) = 3.39$, $p = .08$, $R^2 = .11$ (see Table 1). Tukey's post-hoc test revealed that the HPA group had different attentional biases as a function of type of threat; no difference was revealed for LPA. The HPA group focused their attention toward pain-related threat words ($M = 19.79$) significantly more than toward social threat words, for which there was an avoidance attentional pattern ($M = -18.31$). The vigilance attentional bias for pain words was significantly different from zero, $t(14) = 2.28$, $p < .05$, $R^2 = .27$. The avoidance attentional pattern for social words was also significantly different from zero, $t(14) = 2.49$, $p < .05$, $R^2 = .31$. No significant group difference was revealed for the pain threat words ($p = .09$) or social threat words ($p = .50$).

Vigilance attentional bias: distinction between facilitated detection of threat and difficulty disengaging attention from pain-related threat words

There was a significant between-groups difference for the indexes of difficulty disengaging from pain-related threat words, $t(28) = 2.60$, $p < .05$, $R^2 = .19$ ($M_{\text{HPA}} = 30.86$ and $M_{\text{LPA}} = -3.98$). Compared to LPA participants, HPA participants had greater difficulty disengaging their attention from pain-related threat stimuli. The index of difficulty disengaging from threat significantly differed from zero for HPA, $t(14) = 3.31$, $p < .05$, $R^2 = .44$, but not for LPA, $t(14) = 0.41$. No group difference was found for the facilitated detection of pain-related threat index, $t(28) = .83$, $p = .41$.

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Discussion

The aim of the present study was to examine the effect of pain-related anxiety on attentional processes in professional rugby players. We hypothesized that individuals with HPA level would show an attentional bias only toward pain-related threat. We expected also that this hypervigilance for pain-related threat would reflect difficulty disengaging attention from threat rather and not facilitated detection of threat. Both hypotheses were supported.

Although the interaction failed to reach conventional significance and the effect size of the interaction was moderate ($R^2 = .15$), rugby players with HPA showed a strong vigilance attentional bias towards pain-related threat stimuli ($R^2 = .27$), as hypothesized. In a recent meta-analysis of research using the visual-probe task to explore attentional bias (Schoth et al., 2012), the means of vigilance attentional bias in chronic pain individuals ranged from 5.05 to 19.92. The mean of the HPA group in the present study was close to the highest reported in this meta-analysis ($M = 19.79$, $SD = 28.81$). Rugby players with HPA thus seem to present an attentional bias similar to that of individuals suffering from chronic pain (Crombez et al., 2005; Schoth et al., 2012). Although the vigilance attentional bias was high for the HPA group, it was not significantly different to the attentional bias of the LPA group ($M = -5.41$, $SD = 35.32$). This lack of statistically significant difference is likely due to the high degree of inter-individual variability in both groups, especially in the LPA group. Such inter-individual variability points to likely additional inter-individual moderators of attentional bias, which we discuss later.

The results of the present study appear to corroborate the idea that the difficulty disengaging from pain-related stimuli may be an important vulnerability marker in athletes who face pain and/or injury. Indeed, the pain-related anxious ($M = 90.82$) rugby players seemed to demonstrate a selective attentional bias for pain-related material similar to that of chronic pain individuals (mean pain-related anxiety ranging 80–100; Abrams et al., 2007) with great difficulty disengaging from pain-related stimuli ($R^2 = .44$). This selective attentional pattern for pain threat may indicate a latent predisposition toward pain stimuli (Eysenck, 1992). However, the existence of attentional biases does not necessarily imply that such biases cause negative responses to pain, but rather that they may be taken as an important vulnerability marker for such negative responding.

Rugby players reported a HPA mean. It is possible that the frequency of exposure to pain is associated with increased anxiety in this population. Indeed, the regular exposure to the stressor is known to increase anxiety (e.g., Mogg & Bradley, 1998). The attentional pattern of the HPA group (e.g., the group that had difficulty disengaging from pain-related stimuli) may also explain this high anxiety. According to Cisler et al. (2009), sustained difficulty disengaging attention from pain may be an important factor in maintaining pain and injury, and may serve to increase anxiety. Furthermore, as the sample of this study was young, it is possible that the athletes were less able to manage their pain and pain-related anxiety. It may also be that this high level of pain-related anxiety is temporary and associated with the arrival at the French Rugby Center, thus reflecting a maladaptive emotional management. It would be interesting to measure the anxiety level one month after in order to control the stability.

Pain-related anxiety is clearly not the only factor involved in the cognitive processes that is associated with attentional bias to pain-related threat. Other factors such as fear of (re-)injury and catastrophic thinking about pain can also play an important role in the emergence of attentional bias (Khatibi, Dehghani, Sharpe, Asmundson, & Pouretemad, 2009). Catastrophic thinking about pain is defined as an exaggerated negative orientation toward actual or anticipated pain experiences (Sullivan, Bishop, & Pivik, 1995). Participants who have catastrophic thoughts about pain have been shown to be hypervigilant to pain and have difficulty disengaging from pain (Crombez et al., 2005; Van Damme et al., 2004). The role of fear of injury and catastrophic thinking in the relationship between pain-related anxiety and attentional bias is thus worth exploring in the context of a moderation or mediation model.

The current study demonstrated a vigilance attentional bias in rugby players who have HPA. There are some applied implications that are worth considering in light of these findings. The results can help in the choice of psychological methods proposed and utilized in managing injury and pain. There are currently a range of interventions, such as mindfulness meditation, attentional re-training, and other techniques aimed at reducing the threat value of pain (Crombez et al., 2002). Exercises of interoceptive exposure (i.e., exposure to anxiety-provoking bodily sensations) may also prove fruitful. The works of Watt and others (Carleton, Abrams, Asmundson, Antony, & McCabe, 2009; Stewart & Watt, 2008; Watt, Stewart, Lefaivre, & Uman, 2006) have highlighted the efficacy of this exposure method in decreasing pain-related anxiety and anxiety sensitivity. Distraction is also an attentional strategy commonly used to control pain and the ability to switch between pain and other demands is thought to be necessary to cope with pain. Difficulty in disengaging from pain-related stimuli may lead to an overestimation of the stimuli's impact or importance, and may reflect an incapacity for distraction. Verhoeven et al. (2011) showed that good inhibition abilities are associated with good performance on a distracting task despite the presence of pain, thus suggesting that individuals should practice their ability to maintain attentional focus and inhibit distracting information in order to manage their pain effectively. According to Eysenck, Derakshan, Santos, and Calvo (2007), the executive functioning of inhibition plays an important role in attentional control. The inhibition function is used to prevent task-irrelevant stimuli and responses from disrupting performance. The study of the relationship between inhibition function, management pain, and attentional processes certainly appears worthwhile.

Despite support for the main hypothesis, there are some limitations in the protocol that are worth addressing. One limitation is that pain-related anxiety is not the only factor that is likely to influence pain management. Other factors such as pain tolerance, catastrophic thinking, or inhibition and shifting abilities may also play an important role. More research is needed to better understand the processes underlying these attentional biases, and the implication of these factors. A second limitation is that the sample consisted of professional rugby men who were, by definition of their sport, highly exposed to pain. Future research should, therefore, investigate whether the results are robust for other sports in which pain may be less prevalent. Moreover, no information was obtained about the participants' current pain level, history of injury, and pain/disability due to sports injury. In subsequent studies, the inclusion of these variables, as well as the differentiation of the type of pain words (affective or sensitive pain words), will be necessary.

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In summary, this is the first study that has identified pain-related anxiety as a vulnerability marker in athletes' attentional biases. The current study shows evidence of attentional biases toward pain-related stimuli, and difficulty disengaging from stimuli in professional rugby men with HPA. However, pain-related anxiety does not fully explain the maladaptive attentional process. The results of this study can be considered as an important first step in understanding the role of attentional factors in pain-related anxiety in sport contexts.

References

Abrams, M.P., Carleton, R.N., & Asmundson, G.J.G. (2007). An exploration of the psychometric properties of the PASS-20 with a nonclinical sample. *The Journal of Pain*, *8*(11), 879–886. doi:10.1016/j.jpain.2007.06.004

Aldrich, S., Eccleston, C., & Crombez, G. (2000). Worrying about chronic pain: Vigilance to threat and misdirected problem solving. *Behaviour Research & Therapy*, *38*(5), 457–470. doi:10.1016/S0005-7967(99)00062-5

Asmundson, G.J.G., & Larsen, D.K. (2000). Pain anxiety symptoms scale. In J. Maltby, C.A. Lewis, & A.P. Hill (Eds.), *Commissioned reviews of 250 psychological tests* (pp. 607–612). Wales, UK: Edwin Mellen Press.

Asmundson, G.J.G., Kuperos, J.L., & Norton, R.G. (1997). Do patients with chronic pain selectively attend to pain-related information? Preliminary evidence for the mediating role of fear. *Pain*, *72*(1–2), 27–32. doi:10.1016/S0304-3959(97)00010-9

Bar-Haim, Y., Lamy, D., Pergamin, L., Bakermans-Kranenburg, M.J., & van IJzendoorn, M.H. (2007). Threat-related attentional bias in anxious and nonanxious individuals: A meta-analytic study. *Psychological Bulletin*, *133*(1), 1–24. doi:10.1037/0033-2909.133.1.1

Bardel, M.-H., Woodman, T., Colombel, F., & Le Scanff, C. (2012). Attentional patterns involved in coping strategies in a sport context. *Research Quartely for Exercise and Sport*, *83*(4), 597–602. doi:10.5641/027013612804582623

Caine, D.J., & Lindner, K. (1990). Preventing injury to young athletes - Part II: Preventive measures. *Journal of the Canadian Association for Health Physical Education and Recreation*, *56*, 24–30.

Carleton, R.N., Abrams, M.P., Asmundson, G.J.G., Antony, M.M., & McCabe, R.E. (2009). Pain-related anxiety and anxiety sensitivity across anxiety and depressive disorders. *Journal of Anxiety Disorders*, *23*(6), 791–798. doi:10.1016/j.janxdis.2009.03.003

Carleton, R.N., Asmundson, G.J.G., Collimore, K.C., & Ellwanger, J. (2006). Strategic and automatic threat processing in chronic musculoskeletal pain: A startle probe investigation. *Cognitive Behaviour Therapy*, *35*(4), 236–247. doi:10.1080/16506070600898504

Carleton, R.N., Richter, A.A., & Asmundson, G.J. (2011). Attention modification in persons with fibromyalgia: A double blind, randomized clinical trial. *Cognitive Behaviour Therapy*, *40*(4), 279–290. doi:10.1080/16506073.2011.616218

Cisler, J.M., Bacon, A.K., & Williams, N.L. (2009). Phenomenological characteristics of attentional biases towards threat: A critical review. *Cognitive Therapy and Research*, *33*(2), 221–234. doi:10.1007/s10608-007-9161-y

Crombez, G., Eccleston, C., Vlaeyen, J.W., Vansteenwegen, D., Lysens, R., & Eelen, P. (2002). Exposure to physical movements in low back pain patients: Restricted effects of generalization. *Health Psychology*, *21*(6), 573–578. doi:10.1037//0278-6133.21.6.573

Crombez, G., Van Damme, S., & Eccleston, C. (2005). Hypervigilance to pain: An experimental and clinical analysis. *Pain*, *116*(1–2), 4–7. doi:10.1016/j.pain.2005.03.035

Deroche, T., Woodman, T., Stephan, Y., Brewer, B.W., & Le Scanff, C. (2011). Athletes' inclination to play through pain: A coping perspective. *Anxiety, Stress & Coping*, *24*(5), 579–587. doi:10.1080/10615806.2011.552717

Eysenck, M.W. (1992). *Anxiety: The cognitive perspective*. Hove: Erlbaum.

Eysenck, M.W., Derakshan, N., Santos, R., & Calvo, M.G. (2007). Anxiety and cognitive performance: Attentional control theory. *Emotion*, *7*(2), 336–353. doi:10.1037/1528-3542.7.2.336

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Gotlib, I.H., & Joormann, J. (2010). Cognition and depression: Current status and future directions. *Annual Review of Clinical Psychology*, *6*, 285–312. doi:10.1146/annurev.-clinpsy.121208.131305
Keogh, E., Dillon, C., Georgiou, G., & Hunt, C. (2001). Selective attentional biases for physical threat in physical anxiety sensitivity. *Journal of Anxiety Disorders*, *15*(4), 299–315. doi:10.1016/S0887-6185(01)00065-2
Keogh, E., Ellery, D., Hunt, C., & Hannent, I. (2001). Selective attentional bias for pain-related stimuli amongst pain fearful individuals. *Pain*, *91*(1), 91–100. doi:10.1016/S0304-3959(00)00422-X
Khatibi, A., Dehghani, M., Sharpe, L., Asmundson, G.J.G., & Pouretemad, H. (2009). Selective attention towards painful faces among chronic pain patients: Evidence from a modified version of the dot-probe. *Pain*, *142*(1/2), 42–47. doi:10.1016/j.pain.2008.11.020
Koster, E.H., Crombez, G., Verschuere, B., & De Houwer, J. (2004). Selective attention to threat in the dot probe paradigm: Differentiating vigilance and difficulty to disengage. *Behaviour Research & Therapy*, *42*(10), 1183–1192. doi:10.1016/j.brat.2003.08.001
Lautenbacher, S., Huber, C., Schofer, D., Kunz, M., Parthum, A., Weber, P.G., … Sittl, R. (2010). Attentional and emotional mechanisms related to pain as predictors of chronic postoperative pain: A comparison with other psychological and physiological predictors. *Pain*, *151*(3), 722–731. doi:10.1016/j.pain.2010.08.041
Liston, K., Reacher, D., Smith, A., & Waddington, I. (2006). Managing pain and injury in non-elite Rugby Union and Rugby League: A case study of players at a British University. *Sport in Society*, *9*(3), 388–402. doi:10.1080/17430430600673407
McCracken, L.M. (1997). "Attention" to pain in persons with chronic pain: A behavioral approach. *Behavior Therapy*, *28*(2), 271–284. doi:10.1016/S0005-7894(97)80047-0
McCracken, L.M., Zayfert, C., & Gross, R.T. (1992). The Pain Anxiety Symptoms Scale: Development and validation of a scale to measure fear of pain. *Pain*, *50*(1), 67–73. doi:10.1016/0304-3959(92)90113-P
Mogg, K., & Bradley, B.P. (1998). A cognitive-motivational analysis of anxiety. *Behaviour Research & Therapy*, *36*(9), 809–848. doi:10.1016/S0005-7967(98)00063-1
Mogg, K., Mathews, A., Bird, C., & Macgregor-Morris, R. (1990). Effects of stress and anxiety on the processing of threat stimuli. *Journal of Personality and Social Psychology*, *59*(6), 1230–1237. doi:10.1037/0022-3514.59.6.1230
Nixon, H.L. (1992). A social network analysys of influences on athletes to play with pain and injuries. *Journal of Sport & Social Issues*, *16*(2), 127–135. doi:10.1177/019372359201600208
Pincus, T., & Morley, S. (2001). Cognitive-processing bias in chronic pain: A review and integration. *Psychological Bulletin*, *127*(5), 599–617. doi:10.1037/0033-2909.127.5.599
Price, D.D. (1999). *Psychological mechanisms of pain and analgesia*. Seattle, WA: International Association for the Study of Pain.
Radeaux, M., Mousty, P., & Content, A. (1990). BRULEX: Une base de données lexicale informatisée pour le français écrit et parlé [A computerized lexical data base for the French language]. *L'Année Psychologique*, *90*(4), 551–566.
Schoth, D.E., Nunes, V.D., & Liossi, C. (2012). Attentional bias towards pain-related information in chronic pain; A meta-analysis of visual-probe investigations. *Clinical Psychology Review*, *32*(1), 13–25. doi:10.1016/j.cpr.2011.09.004
Sharpe, L., Dear, B.F., & Schrieber, L. (2009). Attentional biases in chronic pain associated with rheumatoid arthritis: Hypervigilance or difficulties disengaging? *The Journal of Pain*, *10*(3), 329–335. doi:10.1016/j.jpain.2008.10.005
Stewart, S.H., & Watt, M.C. (2008). Introduction to the special issue on interoceptive exposure in the treatment of anxiety and related disorders: Novel applications and mechanisms of action. *Journal of Cognitive Psychotherapy*, *22*(4), 291–302. doi:10.1891/0889-8391.22.4.291
Sullivan, M.J.L., Bishop, S.R., & Pivik, J. (1995). The Pain Catastrophizing Scale: Development and validation. *Psychological Assessment*, *7*, 524–532. doi:10.1037/1040-3590.7.4.524
Sullivan, M.J.L., Tripp, D.A., Rogers, W., & Stanish, W. (2000). Catastrophizing and pain perception in sports participants. *Journal of Applied Sport Psychology*, *12*, 151–167. doi:10.1080/10413200008404220
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Van Damme, S., Crombez, G., & Eccleston, C. (2004). Disengagement from pain: The role of catastrophic thinking about pain. *Pain*, *107*(1–2), 70–76. doi:10.1016/j.pain.2003.09.023

Van Damme, S., Crombez, G., Eccleston, C., & Koster, E.H.W. (2006). Hypervigilance to learned pain signals: A componential analysis. *The Journal of Pain*, *7*(5), 346–357.

Verhoeven, K., Van Damme, S., Eccleston, C., Van Ryckeghem, D.M.L., Legrain, V., & Crombez, G. (2011). Distraction from pain and executive functioning: An experimental investigation of the role of inhibition, task switching and working memory. *European Journal of Pain*, *15*(8), 866–873. doi:10.1016/j.ejpain.2011.01.009

Vlaeyen, J.W.S., & Linton, S.J. (2000). Fear-avoidance and its consequences in chronic musculoskeletal pain: A state of the art. *Pain*, *85*(3), 317–332. doi:10.1016/S0304-3959(99)00242-0

Vlaeyen, J.W.S., & Linton, S.J. (2006). Are we "fear-avoidant"? *Pain*, *124*(3), 240–241. doi:10.1016/j.pain.2006.06.031

Watt, M.C., Stewart, S.H., Lefaivre, M.-J., & Uman, L.S. (2006). A brief cognitive-behavioral approach to reducing anxiety sensitivity decreases pain-related anxiety. *Cognitive Behaviour Therapy*, *35*(4), 248–256. doi:10.1080/16506070600898553

Young, K., White, P., & McTeer, W. (1994). Body talk: Male athletes reflect on sport, injury, and pain. *Sociology of Sport Journal*, *11*(2), 175–194.

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