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Psychological skills and "the Paras":

The indirect effects of psychological skills on endurance

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Abstract

We examined the indirect effects of basic psychological skills (PS) on military endurance through enhanced advanced PS, whilst controlling for fitness. British Army recruits (n = 159) participated in three endurance events for Parachute Regiment selection and completed an adapted Test of Performance Strategies questionnaire (Hardy et al., 2010). Following confirmatory factor analyses, the multiple mediation regression analyses using PROCESS (Hayes, 2013) suggested that goal-setting, imagery and relaxation all had positive indirect effects on endurance via activation, with goal setting also impacting on endurance via negative thinking. These data provide some support for basic PS influencing endurance via advanced PS.

Psychological skills and the Paras: The indirect effects of psychological skills on endurance

Sport psychology research has application that reaches beyond the sporting domain into military training and combat contexts (Goodwin, 2008). Indeed, there are a number of parallels between sports teams and military units including: (a) they both operate in dynamic and complex environments; (b) they require effective utilization of perceptual, cognitive, and motor skills; (c) they necessitate performance under stressful conditions; and (d) they both seek tactical advantages over opponents (Ward et al., 2008). Furthermore, many sports events have evolved from military tasks such as: marksmanship (e.g., rifle shooting, archery), overcoming physical obstacles or defences (e.g., pole vault, high jump and cross country running), and navigation (e.g., orienteering, sailing; Goodwin, 2008). Given the similarities between sport and military performance, the application of sport psychology in the military is increasingly being recognized (e.g., Adler et al., 2015).

Over the past 40 years, numerous studies have demonstrated that psychological skills (PS) benefit athlete well-being and performance (e.g., Hayslip, Petrie, MacIntyre, & Jones, 2010; Thelwell & Greenlees, 2003) and initial research has linked PS training and military performance (Hammermeister, Pickering, McGraw, & Ohlson, 2010). One recent longitudinal experiment (Adler et al., 2015) revealed improvements in self-confidence and performance on a 20m aerial obstacle task for soldiers completing PS training in comparison to soldiers in an active control condition. However, it remains unclear exactly how such effects emerged. Indeed, in a broader sense, within sport related research, the mechanisms via which PS impact on performance are still not fully understood and the conceptualization of the term ‘PS’ remains ambiguous (cf. Tremayne & Newberry, 2005).

Conceptualization of psychological skills

Despite the plethora of research investigating PS in sport, a functional definition of PS is far from agreed upon and researchers often fail to provide clear distinctions between mental skills (e.g., imagery, goal setting) and mental qualities (e.g., confidence, motivation; cf. Holland, Woodcock, Cumming, & Duda, 2010). As such, multiple PS frameworks and questionnaires (e.g., Vealey, 1988; Durand-Bush, Salmela, & Green-Demers, 2001; Smith, Schutz, Smoll, & Ptacek, 1995) present inconsistencies in relation to the definition of 'psychological skill' and include concepts which we would not consider to be PS. As Tremayne and Newberry (2005) highlighted, typically 'skill' refers to either an act/task being performed or an indicator of the standard of performing a task, and a central feature of a 'skill' is that improvement is possible with practice. Therefore, whilst there are relevant subscales within inventories such as the Ottawa Mental Skills Assessment Tool (OSMAT 3: Durand-Bush et al., 2001) and the Athletic Coping Skills Inventory-28 (ACSI-28: Smith et al., 1995) for example goal setting, imagery, relaxation and focusing, some subscales (e.g., confidence, commitment, achievement motivation) are not skills as they do not describe specific activities or abilities. Rather, we deem them to be the psychological outcomes which are likely to arise from using PS. For instance, it is difficult to conceive carrying out "confidence" or being good at 'achievement motivation". Indeed, more detailed scrutiny is warranted regarding the rationales proposed for PS measures. As an example, in the development of the ACSI-28 there is little to no definition of coping skills and little reference to the extensive theoretical basis of coping to inform the inclusion of certain subscales. Indeed whilst some PS, such as goal setting and concentration, are measured within the ACSI-28, other PS (e.g., self-talk) are not included.

In light of such inconsistency, we argue that the Test of Performance Strategies (TOPS; Thomas, Murphy, & Hardy, 1999) and the more recent TOPS-2 (Hardy, Roberts, Thomas, & Murphy, 2010) offers more conceptual clarity and is more appropriately aligned with the two possible meanings of the word skill. Within the TOPS, basic skills (goal-setting, imagery, relaxation and self-talk) have been outlined as acts or tasks that can be performed and practised, and advanced skills (automaticity, emotional control, attentional control, reduced negative thinking, activation) are indicators of the level of ability. The TOPS authors suggest that performers who regularly practise using basic PS will eventually improve their ability with the more advanced PS, which will ultimately influence performance. As such, we believe the TOPS has the most appropriate conceptualization of PS and provides a clear and testable model of PS scales, which we endeavoured to assess.

Multiple investigations have reported correlations between scores from the TOPS/ TOPS-2 and levels of athletic performance (Hayslip et al., 2010), flow experience (Jackson, Thomas, Marsh, & Smethurst, 2001), anxiety responses (Fletcher & Hanton, 2001), and most recently, military performance (Adler et al., 2015). More broadly, the TOPS scales have been frequently cited, used as a measurement tool in a wide range of studies and are readily advocated assessment tools (e.g., Burton & Raedeke, 2008). However, there has yet to be a test of the indirect effect proposed by Hardy, Thomas and colleagues (1996; 1999; 2010) and empirical evidence regarding its conceptual validity is needed. That is, goal setting, relaxation, self-talk, and imagery influence performance via an increased ability to control one's emotions and attentional focus, perform automatically (without over-thinking), resist negative thinking and ready oneself to perform (activation). In the present study, we provide the first empirical test of this theorizing and examine the indirect effects of basic PS on performance using a military context.

Psychological skills and Endurance

Traditional views of endurance (the ability to sustain aerobic exercise over prolonged periods) place a central relevance on muscle fatigue as the major contributing factor to sustained performance or exhaustion (e.g., Allen, Lamb, & Westerblad, 2008). However, more contemporary perspectives also consider the psychological contributing factors. Recently, McCormick, Meijen, and Marcora, (2015) conducted a systematic literature review of psychological interventions targeting aerobic endurance and concluded that the basic PS of goal setting, imagery, and self-talk as well as PS training packages all enhanced endurance. They also noted the lack of research regarding the psychological mechanisms underlying these improvements (hampering researchers' ability to refine these interventions) and also a need for more psychology oriented endurance studies to be conducted in ecologically valid contexts. Furthermore, the effects of PS use over and above pre-existing physical fitness have not yet been isolated. Therefore, we investigated the mechanisms (advanced PS) explaining the relationship between the strategic use of basic PS and endurance whilst controlling for pre-existing fitness levels. The endurance tasks utilized within the study were part of a genuine military assessment for acceptance into the British Parachute Regiment (an elite branch of infantry soldiers); therefore, all participants were high level performers who experienced real consequences as a result of their performance helping to assure the ecological validity of the data.

Given the evidence provided thus far, it seems reasonable to suggest that soldiers' use of the four basic PS (i.e., goal-setting, relaxation, self-talk, and imagery) would enhance their endurance. With regards to the mechanisms or advanced PS (attentional control, emotional control, negative thinking, activation, and automaticity) through which use of each basic PS might impact on endurance, it is necessary to consider the psychological demands of endurance tasks (Taylor, 1995) and how using each specific PS could assist athletes to deal with such demands.

In the present case, while initial training for the infantry is necessarily arduous, training for Parachute Regiment (Para) recruits is widely regarded by the British Army as the most physically and mentally demanding of all its infantry regiments (Wilkinson, Rayson, & Bilzon, 2008). The Paras' specialist role as elite soldiers requires them to operate at a higher intensity than the regular infantry, carrying heavy loads for longer distances, at a faster pace, as well as withstanding the hardships of operating independently in the field for long periods under harsh environmental conditions (Wilkinson et al., 2008). In order to take part in the Para selection process, recruits are required to pass multiple military selection tests and undertake specific Para selection training. Thus, only the highest performing recruits are invited to undergo Para selection which involves a series of very demanding individual and team events. For example, individual tasks involving carrying personal equipment weighing 20kg or more for distances of up to 32km over severe terrain with time constraints, and team events requiring participants to run with an 80kg stretcher for 8km are commonplace within selection.

Therefore to be successful, Para recruits need to effectively deal with the psychological demands of pain and fatigue with appropriate PS use. Specifically, they are required to counter the effects of fatigue and associated negative thoughts to exert attentional and emotional control to maintain an appropriate intensity for sustained periods. Indeed, negative thinking, attentional focus on negative cues and experiencing negative emotions are thought to be related to lower pain tolerance (Meagher, Arnau, & Rhudy, 2001) and poorer endurance (Brewer, Van Raalte, & Linder, 1996). We therefore expected that the advanced PS of attentional control, emotional control, negative thinking, and activation would all correlate with endurance. On the contrary, whilst the advanced PS of automaticity (i.e., the ability to perform motor tasks without consciously thinking about the movements) has been implicated in the execution of fine motor tasks (cf. Masters, 1992), there is little evidence endorsing its relevance in endurance-oriented tasks. Consequently we thought it unlikely that automaticity would be related to endurance, also negating any indirect effects of basic PS on endurance via automaticity.

When formulating specific hypotheses concerning the indirect effects of soldiers' use of each basic PS on endurance, multiple advanced PS should apply to each basic PS. For instance, goal setting can increase perceptions of control (Locke & Latham, 2002), direct attention towards to the specific task, and reduce negative emotions (Kingston & Hardy, 1997). Furthermore, the setting of challenging, specific, and results driven goals ought to increase the effort and intensity at which tasks are completed (Locke & Latham, 2002). Past endurance-specific research reveals that individuals completing triathlon events perceive goal setting to beneficially impact on their attentional focus, mood states, and positive thinking (Thelwell & Greenlees, 2003). Accordingly, we hypothesized indirect effects of goal setting on soldiers' endurance via enhanced activation, attentional and emotional control, and reduced negative thinking.

Imagery and self-talk have been found to be effective “psyching up” techniques for athletes (e.g., Burhans, Richman, & Bergey, 1988). Imagery and self-talk can also aid physiological activation when nearing fatigue by reducing perceived stress (Hatzigeorgiadis, Zourbanos, & Theodorakis, 2007; Jones, Bray, Macrae, & Stockbridge, 2002), and encouraging facilitative perceptions of the body’s response to stress (e.g., Cumming, Olphin, & Law, 2007). Therefore, we expected that activation and emotional control would be relevant to understanding both imagery and self-talk’s indirect effects on endurance. Furthermore, the use of imagery and self-talk can serve an affirmatory purpose thus assisting performance by reducing levels of negative thinking (Mace & Carroll, 1986). Previous research has also reported that imagery and ST use can enhance athletes’ attentional control (Calmels, Berthoumieux, & D’Arripe-Longueville, 2004; Hatzigeorgiadis et al., 2007) and so could assist to block out irrelevant stimuli, such as pain. Indeed, upon completing endurance tasks, performers reportedly use imagery and self-talk to help prepare and cope with pain and fatigue aiding their attentional focus (Thelwell & Greenlees, 2003). Therefore we hypothesized that imagery and self-talk would indirectly impact upon the soldiers’ endurance through improved activation, attentional and emotional control, and reduced negative thinking.

Finally, relaxation strategies in combination with other techniques have been shown to enhance endurance related measures (e.g., Caird, McKenzie, & Sleivert, 1999) but comparatively less research with an exclusive emphasis on relaxation has been conducted. Relaxation strategies are thought to impact on athletes’ arousal state, tension and readiness to perform, and breathing techniques can assist attentional focus on goals and appropriate sensations (e.g., steady breathing) rather than pain (Thelwell & Greenlees, 2003). Hence, soldiers’ use of relaxation strategies should have indirect effects on endurance by aiding activation, emotional and attentional control and reducing negative thinking (e.g., anxiety-provoking thoughts and tension, see Fletcher & Hanton, 2001).

As presented, there is a range of literature which supports the proposed relationships between basic PS, advanced PS and performance. However, few of these studies test mediating relationships and there is yet to be an empirical test of all such relationships in a single study, using endurance tasks. Indeed, the collective volume of research on PS is a rather disparate mass of literatures that tends to focus on single PS and tend to ignore multiple possible mechanisms via which PS use influence outcomes in concert. Although most researchers forward mechanistic reasons why their PS of choice should influence performance, mediation effects are rarely formally evaluated. In fact, there is a large body of literature that collects qualitative (e.g., social validity) data that is not capable of providing meaningful insight into this important aspect (e.g., Thelwell & Greenlees, 2003). When researchers have focused on mediation they tend of employ a very narrow approach (e.g., Short, Tenute & Feltz, 2005), yielding very focussed (and partial) but not a comprehensive understanding regarding possible mediators. As a result, empirical data concerning PS and their associated mechanisms could still offer more guidance to practitioners. Furthermore, given that the PS literature is founded on the premise of modelling lesser skilled athletes' use of PS on how elite performers utilize these mental skills, it is unfortunate that much of the available findings are not commonly gleaned from elite samples. Indeed, numerous researchers (e.g., Greenspan & Feltz, 1989; Hardy, Begley, & Blanchfield, 2015) have previously argued that the effects of PS for novices (e.g., Thelwell & Greenlees, 2003), might not apply to higher level performers (e.g., Para recruits). The vast majority of existing research is also ambiguous with regard to the context (e.g., practice or competition) within which PS are being examined and there are relatively few studies involving endurance; those that do have not controlled for pre-existing fitness levels. Finally, while previous research has acknowledged that there is a variety of PS relevant for performance, very few studies have examined how these ought to be meaningfully conceptualized to develop a coherent appreciation of their effectiveness.

We believe that the present investigation addresses the aforementioned limitations, as the first quantitative assessment of multiple indirect effects of PS use within an ecologically valid endurance setting with elite military recruits. We draw from Hardy and colleagues' (1996; 2010; Thomas et al., 1999) previously untested theorizing regarding the indirect effects of basic PS on performance via advanced PS. Specifically, we hypothesized that after controlling for pre-existing fitness levels, elite infantry soldiers (i.e., Para recruits) reporting strategic use of the four basic PS (goal setting, relaxation, self-talk, and imagery) would have facilitatory indirect effects on their endurance, via increased levels of advanced psychological functioning, specifically via enhanced attentional control, emotional control, activation, and reduced negative thinking. We did not expect any of the basic PS to have an indirect effect on endurance via automaticity.

Method

Participants

We recruited 192 male British Army Parachute Regiment (Para) recruits (M_{age} = 21.04, *SD* = 3.62) to take part in the study. Nine (5%) were removed due to injury and six (3%) due to non-completion of the Pre Para selection event. Therefore, a total of 183 participants completed the Pre Para selection event, however 24 failed to complete the 2-mile run prior to Pre Para selection (which we used as a covariate, see Measures). Thus, we ran all analyses on data from 159 participants. All participants had passed a rigorous selection protocol involving initial Army selection, followed by a further screening process known as the Parachute Regiment Aptitude Course (PRAC). Participants were currently undergoing a 28-week Combat Infantryman's Course (CIC), designed to create trained soldiers who were physically and mentally robust enough to operate in hostile environments. During the CIC, there are a number of critical tests (e.g., shooting, fitness) which have to be passed in order to progress. Failure to meet the required standards at any point in training results in a recruit being reallocated to another platoon at an earlier stage of training. Thus, this training is necessarily stressful and designed to produce high performing recruits. The training staff also stated that the recruits had not received any PS specific education as part of their official military training.

Endurance – "P Company"

Before being able to pass the CIC and progress onto parachute training, recruits are required to successfully complete a Pre-Para Selection test week (PPS; colloquially known as P- Company) at Week 20 of the CIC. The purpose of P Company is predominantly to test the physical fitness and mental robustness of potential Parachute Regiment soldiers, in order to confirm their suitability to serve in an airborne unit. During P Company, participants complete a series of eight arduous tests; six different endurance events (two team tasks and four individual tasks), an aerial confidence test and a physical combat task. A maximum of 10 points can be achieved for their performance on each task (the aerial confidence task is pass/fail thus a total of 70 marks are available). Points are awarded for each task by P Company staff, who are independent from the recruits' regular training team, based on time to complete or completion of an event. In the current sample, scores ranged from 11 to 68 out of a possible 70 points (M = 52.21, SD = 10.29).

To create a measure of endurance that was not confounded by attrition, we selected three of the first four endurance events. That is, the 2-mile loaded run, the 3 km steeplechase assault course, and the team log race. The 2-mile loaded run requires each recruit to carry 20 kg of equipment (including rifle) and is to be completed in less than 18 minutes to achieve the maximum of 10 points. Subsequently, one point is deducted for every 30 second period over the 18 minutes. The steeplechase assault course is a 3 km run over undulating terrain, through water obstacles and over assault course features. Participants achieve 10 points if the task is completed in 19 minutes or less, with one point being deducted for every 30 second period over 19 minutes. Finally, the team log race requires teams of eight recruits to carry a 60 kg log over a taxing 2.8 km course. This task is particularly arduous and recruits often withdraw from carrying their log mid-task due to fatigue. For completion of the course, recruits are awarded six points. If they reach particular stages before withdrawing (yet do not complete the course) recruits are awarded two or four points. Up to four more points may be awarded by PPS staff for effort, determination and teamwork, thus achieving a maximum of 10 points. We created a composite measure of endurance by calculating a mean score from each of the three events.

Measures

Test of Performance Strategies. The TOPS questionnaire was originally designed to measure athlete's use of a wide range of PS in practise and competition. Hardy et al. (2010) subsequently developed an updated version, the TOPS-2, and presented support for the measure's psychometric credentials and established strong convergent and factorial validity ($\chi^2(436) = 695.16$, RMSEA = 0.05, CFI = 0.97, TLI = 0.97, and SRMR = 0.06). In their paper, Hardy et al. (2010) recommended a limited number of improvements that they felt would further enhance the measure. Specifically, they advised the editing of an item in the automaticity (competition) subscale to remove the double negative meaning, and the replacement of the distractibility (competition) scale with an attentional control in competition scale. These suggestions along with the editing of an emotional control (training) item resulted in the TOPS-3.

In the present study, we used a slightly modified version of the TOPS-3 to assess recruits' use of PS during P Company. Here we only used the 36 competition TOPS-3 items and we adjusted the phrasing of the items to better reflect the nature of the current context (i.e., PS use during P Company as opposed to general use in competition). The items divide into nine subscales; goal-setting (e.g., *During PPS I set specific goals for each event*), self-talk (e.g., *I said things to myself during PPS to help my performance*), relaxation (*e.g., I used relaxation techniques during PPS to improve my performance*), imagery *(e.g., I visualized each event on PPS going exactly the way I wanted it to go*), attentional control (e.g., *I was able to control distracting thoughts during PPS*) emotional control, (*e.g., I had difficulty with my emotions during PPS*), activation (*e.g., I was able to get myself physically and mentally ready to perform each event on PPS*), automaticity (e.g., *I was* *able to perform on PPS without having to consciously think about it*), and negative thinking (e.g., *I imagined failing some events during PPS)*. Responses were on a 5-point Likert scale that ranged from 1 (*never*) to 5 (*always*), with a midpoint of 3 (*sometimes*).

To ensure that wording changes did not alter the factor structure of the TOPS-3, we used LISREL and PRELIS 8.80 (Jöreskog & Sörbom, 2006) to conduct single factor confirmatory factor analyses (CFA) for each scale followed by a nine-factor analysis (cf. Jöreskog, 1993). Results revealed that, with the removal of one item from the negative thinking and attentional control scales, the model fit for the nine factor model was acceptable, $\chi^2(428) = 827.56$, $p < .001$, RMSEA = 0.07, TLI= 0.94, CFI = 0.95, SRMR = .09.

Fitness. As a standard part of training, recruits are required to complete a 2-mile loaded run (as described above) at week 18 of the CIC to determine their readiness to attempt P Company. We used the time each recruit took to complete this run as an objective measure of aerobic fitness and included this as a covariate in all analyses.

Procedures

Following institutional ethical approval, the second author collected fitness data in the two weeks before P Company. Three days prior to the beginning of P Company the recruits were informed of the nature of the study and invited to participate, following which each individual completed a consent form.

The eight P Company events took place during a single week for each platoon, with the team log race and steeplechase assault course taking place on the second day and the 2-mile run taking place on the morning of the third day. After these events, recruits who were not able to achieve a pass due to insufficient points obtained were removed from the course, while some had been withdrawn due to injury. On completion of the last event on the fifth day, once the recruits had showered and changed, all participants received standardized instructions regarding the completion of the TOPS-3. The instructions included a written and verbal explanation of the different PS and anti-social desirability instructions explaining the data would be kept confidential and encouraging honestly at all times. The recruits were specifically asked to recall and focus on their psychological state and strategies used during P Company, rather than overly focussing on their estimations of resultant performances. Participants then completed the TOPS-3 in a classroom type environment. At this point, participants had no knowledge of how they had performed on P Company, and whether they had passed or failed. Thus, although questionnaire completion followed completion of all P company events, any bias relating to knowledge of performance was likely to be minimal. P company staff had not provided any feedback to recruits regarding their progress and only made the recruits aware of their P Company performance scores, and whether they had passed or failed selection, when all questionnaires were complete.

Data analysis

We tested the hypotheses concerning the indirect effects of each basic PS on endurance via the advanced PS (activation, attentional control, automaticity, emotional control, negative thinking) using PROCESS (Hayes, 2013) with 10,000 bootstrap samples. PROCESS is a flexible regression based package that is able to test, amongst other things, multiple mediators simultaneously. A strength of PROCESS is that it employs bootstrapping and confidence intervals to assess the size and significance of any effects produced. Bootstrapping is superior to a normal theory approach as it is more powerful, produces more accurate results when applied to conditional indirect effects, and is not based on distributional assumptions (MacKinnon, Lockwood, and Williams, 2004). Lower and upper bound 95% confidence intervals that do not encompass zero indicate significance at the .05 level. PROCESS provides the total indirect effect and the separate indirect effects through each mediator whilst controlling for effects of all the other mediators via bootstrapping. Within multiple mediation models, a significant total indirect effect is not necessary in order to examine specific indirect effects (Hayes, 2013). In addition, PROCESS allows for the inclusion of covariates (in our case fitness) in the model. As part of this multiple mediator strategy, we tested the indirect effects of each basic PS on endurance individually, therefore conducted four analyses in total.

Results

Preliminary analyses

Means, standard deviations, composite reliability, and correlations for the variables measured in this study are displayed in Table 1. All use of basic PS (imagery, relaxation, self-talk, and goal setting) were significantly correlated with each other, however, of the basic PS, only self-talk correlated with endurance. All the advanced PS (activation, attentional control, emotional control, negative thinking, and automaticity) were also significantly correlated with each other and with endurance. Of the advanced PS, activation and attentional control were also significantly correlated with all basic PS (except for attentional control and relaxation) and automaticity was not correlated with any basic PS. Fitness (quicker times on a 2-mile run) was correlated with all advanced PS as well as endurance.

Main Analyses

Figure 1 and Table 2 show the results of the regression analyses including the unstandardized bootstrap estimates of the total and specific indirect effects together with bias corrected and accelerated 95% confidence intervals. Model One (goal setting as the predictor variable and fitness as a covariate) explained 54.57% of the variance in endurance, F (2, 156) = 33.09, $p < .001$. Goal setting was positively related to activation and attentional control, and activation, attentional control and negative thinking all predicted endurance. Of more interest, a significant and positive indirect effect of goal setting on endurance via activation was evident, with the positive indirect effect through negative thinking also being significant.

Model Two (imagery as the predictor variable and fitness as a covariate) explained 54.61% of the variance in endurance, F (2, 156) = 33.15, $p < .001$. Imagery was significantly and positively related to activation and attentional control; more importantly, a positive indirect effect involving activation was evident. Model Three (relaxation as the predictor and fitness as a covariate) explained 54.47% of the variance in endurance, F (2, 156) = 32.90, p < .001. Relaxation's only significant (and positive) indirect effect on performance was via activation. Finally, model four (self-talk as the predictor and fitness as a covariate) explained 56.92% of the variance in endurance, F (2, 156) = 37.39, p < .001. In contrast to the preceding analyses, no significant indirect effects emerged, although a significant total effect of self-talk on endurance was apparent, B = .36, (SE .14), p = .01.

Discussion

The purpose of the study was to examine the indirect effect of basic PS on endurance via advanced PS. The results partially supported the hypotheses, as soldiers' use of goal-setting, imagery and relaxation was indirectly related to their endurance via their perceived levels of activation. Further, use of goal setting was also positively related to endurance via a perceived improved ability to reduce negative thinking. The indirect effects of PS were modest; however this was to be expected as the effects emerged to predict performance in a complex applied environment after controlling for the recruits' pre-existing fitness. Indeed although modest, the effects suggest that PS use is related to endurance over and above soldiers' physical attributes. Interestingly, whilst the self-reported levels of advanced skills of emotional control, attentional control, and automaticity did not mediate the relationship between basic PS use and endurance, all of these three variables were correlated with endurance along with negative thinking. As the first mediational analysis of the indirect effects of multiple PS use on endurance, the results augment previous findings (e.g., Thelwell & Greenlees, 2003) to progress understanding regarding PS and the influential mechanisms during endurance tasks with high level performers (cf. McCormick et al., 2015). Alongside the relative lack of investigation into PS mechanisms in endurance settings, the current research is a long awaited investigation of Hardy et al.'s (1996; 2010; Thomas et al., 1999) conceptualization of PS adopted within the TOPS questionnaire. Indeed, the TOPS questionnaire is a measurement tool used in many research studies (e.g, Adler et al., 2015, Fletcher & Hanton, 2001, Hayslip et al., 2010, Jackson et al., 2001) and is readily available to practitioners (e.g., Burton & Raedeke, 2008) thus empirical evidence regarding its conceptual validity is pertinent.

The current findings indicate that activation, conceptualized as a holistic ability to adopt a readiness to perform (Hardy et al., 2010) was the key factor via which basic PS use were related to endurance. In the present context, such a finding makes conceptual sense. P Company entails considerable pressure to perform, taking place after 20 weeks of training, with a notoriously low pass rate, resulting in membership of the elite Parachute Regiment. The pressurized and arduous nature of P Company means that the soldiers' ability to be psychologically and physiologically ready to perform is likely to be of central importance. Indeed, the results support the notion that the ability to create an ideal performance state and optimal arousal levels promote feelings of flow (Jackson et al., 2001) and assist endurance (Houston, Dolan & Martin, 2011).

The indirect effect of goal setting via negative thinking is consistent with the view that goal setting can aid performance through increases in mood and positive thinking (Thelwell & Greenlees, 2003). However, somewhat surprisingly, no other hypothesized indirect effects emerged for the other advanced PS. Indeed, although goal setting, imagery, self-talk and relaxation have been linked to reduced negative thinking, and attentional and emotional control (e.g., Calmels et al., 2004; Hatzigeorgiardis et al., 2007; Kingston & Hardy, 1997), it seems that in relation to endurance at least, these mechanisms are less relevant. Also, notably self-talk did not have a direct or indirect effect on endurance although it had a total effect. The total effect ignores the role of mediators or covariates thus suggesting that ST is associated with endurance however it exerts its effects via mechanisms other than advanced PS.

The importance of activation relative to the other advanced PS could be due to the nature of both endurance tasks and the specific advanced skills. Indeed, many sporting activities are intermittent in nature, with opportunities for emotional highs and lows based on performance fluctuations. Similarly, many sporting activities require complex techniques and decision making, whereby specific attentional foci can be highly advantageous (Wulf & Shea, 2002). It follows that in comparison to these intermittent, technically oriented sports, during endurance events participants experience fewer sudden shifts in emotions and attentional focus, and have to maintain a constant performance, so have fewer pauses and opportunities to use PS mid-task. Thus, during endurance tasks the relationship between basic PS use and emotional and attentional control could be minimal. As such, whilst Hardy (1996; 2010) and Thomas et al.'s (1999) hypothesis that basic PS have facilitatory effects on performance via enhanced emotional and attentional control, may hold true in other sporting activities, it is perhaps not entirely accurate in an endurance context.

As an alternative explanation, it is possible that the notion of using strategies to ready oneself to perform is likely to be something discernible even to relatively inexperienced performers. However, using basic PS to effectively impact on one's negative thinking, emotional and attentional control requires a degree of self-awareness and understanding of emotions and ideal foci of attention (Wulf & Shea, 2002). Therefore, as new recruits without relevant PS military training, the impact of using basic PS on these advanced PS could be limited. Whilst negative thinking, emotional and attentional control were correlated with endurance, given the task and the limited experience of the recruits, they were not salient mechanisms via which the recruits influenced their performances using basic PS.

In contrast, automaticity and its correlation with endurance was unanticipated and runs contrary to our original hypothesis that operating on 'automatic pilot', would not be relevant to endurance. Nevertheless, some existing research does offer support to the endurance benefits of not attending to the mechanics of task execution during aerobic tasks (e.g., Tenenbaum, 2001). Considering the associations between all of the advanced PS and endurance, there are possible gains to be had in developing alternative means of improving performers' ability in these PS other than through the use of basic PS (e.g., simulation training, mindfulness training etc.).

Study limitations

Despite the interesting results, it is important to note that when distinguishing between types of PS and specific effective PS practices, the use of the TOPS is limited. Although the TOPS-3 is a comprehensive measure of PS use, it examines basic PS use at a broad level (e.g., to what extent does someone use goal setting?) and does not make distinctions between particular aspects of PS, such as process, performance and outcome goals, visual and kinesthetic imagery modalities, and instructional and motivational self-talk. Thus, such a broad coverage of each of the basic PS may preclude precise mechanisms becoming apparent. For example, motivational self-talk may exert its effects via emotional control whereas instructional self-talk does not. Indeed, the total effect of self-talk on endurance may have been due to soldiers referring to either instructional or motivational self-talk when completing questions about their use of self-talk during P Company. Both of these types of statements can enhance performance (see Blanchfield, Hardy, De Morree, Staiano, & Marcora, 2014; Hatzigeorgiardis et al., 2007), yet are likely to work through very different mechanisms that may not have been measured in the present study. We would encourage researchers who are interested in the mechanisms underlying PS to consider each PS in detail when developing hypotheses, as different mechanisms will likely be relevant for different aspects of PS. However, it is important to note that whilst the TOPS precludes such detailed investigation, there is no single questionnaire that measures all aspects of PS and validated measures have not been established for each aspect of specific PS which could be of interest (e.g., process, performance, outcome goals). Moreover, while the CFA analysis suggested that the adapted TOPS-3 nine factor model was factorially valid and the composite reliability of all but one of the subscales was acceptable (>.70), further validation work on the TOPS-3 is required in order to better understand the validity and reliability of the measure.

As well as the suggested measurement issues, another consideration relevant to the current data is the study design from which they originate. In particular, PS are commonly employed as a form of intervention and the investigation's retrospective design limits causal inferences that an experimental design would allow. In particular, the administration of the TOPS-3 following completion of the all performance tasks presents clear limitations to the proposed temporal nature of the relationships found and issues with the retrospective recall of PS use. However, alternative administration of the TOPS-3 was not possible given that we were investigating PS use during a one-off genuine military assessment; so capturing PS use prior to the completion of events was not possible. Furthermore, whilst it would have been preferable to collect PS data during or immediately after each P Company event, this was not possible due to the career implications of P Company performance and the need to rest and protect recruits from disruption of any kind. Therefore, given the unique environment and ecological validity of the study, its design and timing of measurement were necessary.

Implications and future directions

Keeping in mind the current findings, future experiments examining possible mediatory pathways of PS in a longitudinal fashion are warranted. Crucially, further investigation is required regarding the effective application of PS in military settings to extend the evidence base from which practitioners might draw from. In particular, Adler et al.'s (2015) finding that PS training only improved certain military activities further highlights the need to extend knowledge regarding the mechanisms via which PS affect different military tasks (e.g., team and individual endurance tasks). Furthermore, findings that females may benefit more from PS training (cf. Adler et al., 2015), emphasize the need for future investigation of individual differences such as gender and personality traits might moderate the impact of PS use (see Roberts & Woodman, 2015).

The results highlighted that the use of basic PS could improve endurance and basic PS training is likely to assist athletes' endurance by promoting optimal states of activation. In particular the results suggest that PS training could be appropriate in an applied military setting and could help to increase pass rates and thus reduce attrition. Given the resource intensiveness and typically low (40-70%) pass rates for military assessments such as P Company, alongside current slow recruitment and austerity measures, bolstering recruits' use of PS might result in much needed financial savings. Indeed, continuing the current attrition rates in Parachute Regiment training could lead to the P-Company standards being lowered, thereby negatively impacting on the quality of elite combat troops in the Army and the UK's ability to conduct successful combat operations in the future. Conversely, given the lack of relationships between basic and the other advanced PS, practitioners may be wise to question the utility of teaching basic PS and investigate alternative methods of improving recruits and athletes' abilities in areas such as attentional control and automaticity when undertaking endurance tasks. The present findings (e.g., CFA results) might also help to improve the quality of future PS research in military contexts, whilst ensuring practitioners' faith in military TOPS-related data. We continue to believe that the TOPS instrument can play a useful role in educating clients about their PS usage, however further validation work on the TOPS-3 is required.

This study makes a much needed contribution to the study of the psychological mechanisms of PS use in endurance tasks (cf. McCormick et al., 2015). It is also a long over-due test of Hardy, Thomas and colleagues' (1996; 1999; 2010) proposition that could reignite discussion regarding the conceptualization of PS. Indeed, progress regarding the conceptualization of PS has stalled in recent years and we hope this paper compels further mediational investigation, for example the longstanding proposal informing The Ottawa Mental Skills Assessment Tool (OMSAT-3; Durand-Bush et al., 2001) that foundation skills are necessary before developing psychosomatic and cognitive skills remains untested. The results suggest that practitioners in both sport and military environments would be advised to encourage their charges to systematically use the basic PS in order to improve their psychological state and readiness to perform, leading to improved endurance performances. Nonetheless, many of the hypothesized indirect effects of Hardy (1996; 2010) and Thomas et al.'s (1999) hierarchal model of PS were not supported and as such the TOPS model requires further investigation in both endurance and fine motor tasks. Moreover, the nuances evident within the current set of findings illustrate that PS are not a performance-oriented panacea, but reinforce the importance of skilled analysis of task demands and continued empirical investigation, especially with regard to endurance tasks.

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Footnotes

1. The item removed from negative thinking subscale was: “My self-talk during PPS was negative.”. The item removed from attentional control subscale was “My attention wandered on events during PPS.”. For a copy of the adapted TOPS-3 used in the current study email ross.roberts@bangor.ac.uk

Table 1

Descriptive statistics, reliability and intercorrelations of model variables (N = 159)

Measure	Mean	SD	Composite reliability	1	2	3	4	5	6	7	8	9	10
1. Fitness (2 mile run time)	18.10	.88	-	-									
2. Goal-setting	3.72	.81	.79	-.17*	-								
3. Imagery	3.48	.78	.76	-.13	.51**	-							
4. Relaxation	2.66	1.09	.89	-.17*	.40**	.37**	-						
5. Self-Talk	3.55	.89	.83	-.11	.46**	.28**	.44**	-					
6. Activation	3.60	.73	.79	-.48**	.34**	.24**	.36**	.42**	-				
7. Attentional Control	3.83	.71	.63	-.21*	.27**	.33**	.09	.25**	.51**	-			
8. Automaticity	2.96	.82	.74	-.50**	.12	.06	.06	.08	.53**	.17*	-		
9. Emotional control	3.88	.95	.88	-.32**	.17*	.12	.01	.13	.55**	.45**	.46**	-	
10. Negative Thinking	2.30	.79	.70	.37**	-.19*	-.07	-.00	-.17*	-.52**	-.40**	-.32**	-.47**	-
11. Endurance	6.97	1.94	.66	-.55**	.13	.03	.09	.23**	.56**	.24**	.61**	.47**	-.48**

Note. Variable 1: run times ranged from 15.30 minutes to 20.15 minutes; Variables 2 to 10: rated on a 5-point Likert scale from 1 (*never*) to 5 (*always*); Variable 11: the mean points awarded for performance on three endurance events (scored from 1 to 10)

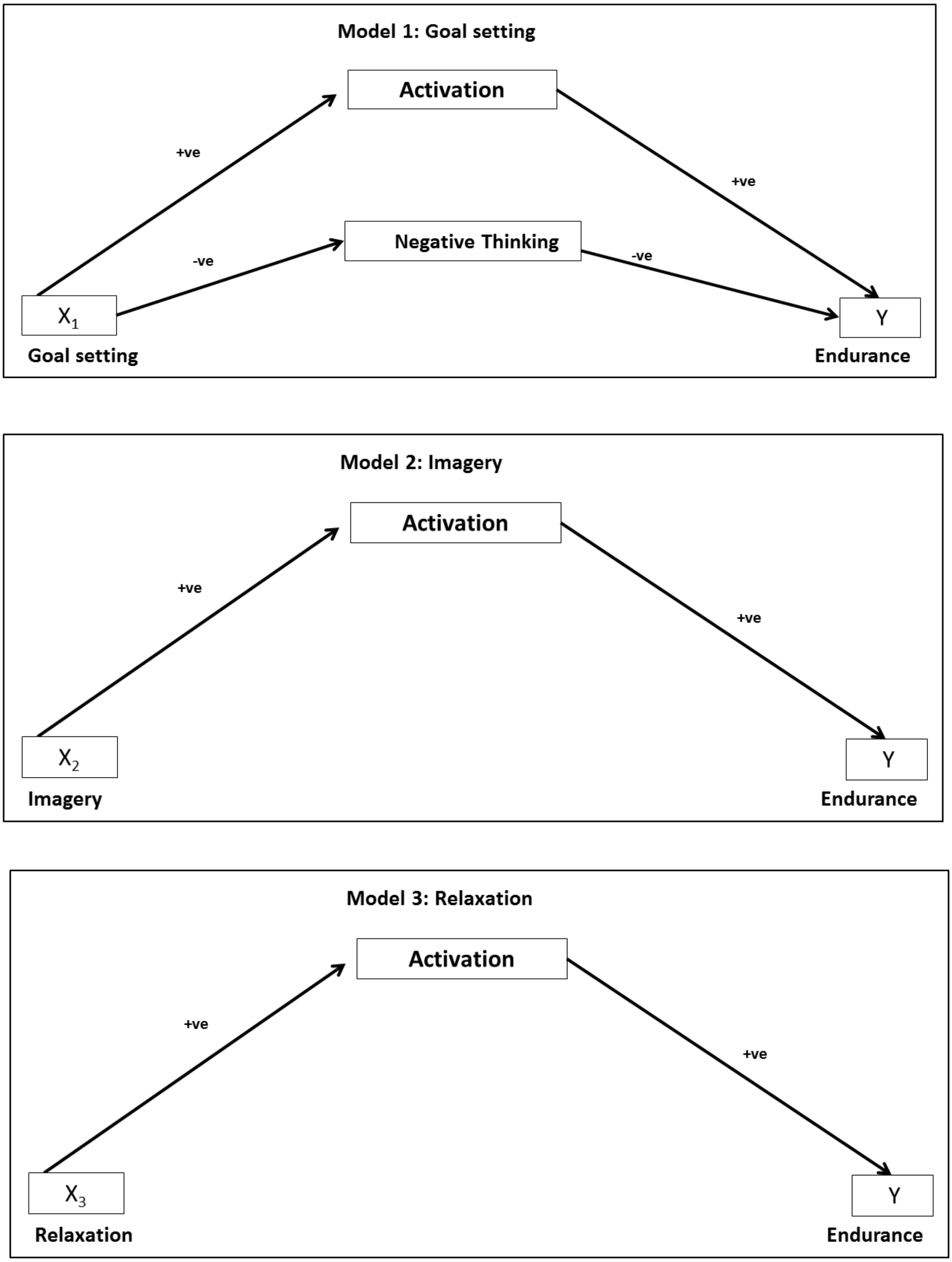
* $p < .05$, ** $p < .001$

Table 2.

Results of mediated regression analyses, the effects of PS use on Endurance

	Model 1: Goal setting				Model 2: Imagery				Model 3: Relaxation				Model 4: Self-talk			
			95% CI				95% CI				95% CI				95% CI	
	B	SE	LL	UL	B	SE	LL	UL	B	SE	LL	UL	B	SE	LL	UL
Predictor (X) to mediators (M1)																
Activation	.24**	.06	.12	.36	.16*	.06	.04	.29	.19**	.04	.10	.28	.30**	.05	.20	.40
Att. Control	.21*	.07	.07	.34	.28**	.07	.14	.41	.03	.05	-.07	.13	.18*	.06	.06	.30
Automaticity	.04	.07	-.11	.18	-.00	.07	-.15	.14	-.02	.05	-.12	.08	.02	.06	-.11	.15
Em. Control	.14	.09	-.04	.31	.10	.09	-.08	.28	-.04	.07	-.17	.09	.10	.08	-.06	.26
Neg. Thinking	-.12	.07	-.27	.02	-.03	.08	-.18	.12	.05	.05	-.06	.15	-.12	.07	-.25	.01
Mediators (M_1) to endurance (Y)																
Activation	.49*	.23	.05	.94	.48*	.22	.05	.92	.51*	.25	.03	1.00	.31	.24	-.16	.78
Att. Control	-.17	.19	-.55	.20	-.13	.20	-.51	.26	-.20	.19	-.57	.18	-.21	-.19	-.58	.16
Automaticity	.74**	.17	.40	1.08	.74**	.17	.40	1.08	.73**	.17	.39	1.08	.78**	.17	.44	1.12
Em. Control	.20	.15	-.10	.50	.19	.15	-.10	.49	.19	.15	-.11	.49	.22	.15	-.07	.52
Neg.Thinking	-.47*	.17	-.81	-.14	-.45*	.17	-.79	-.12	-.46*	.17	-.80	-.12	-.48*	.17	-.81	-.15
Total effect of covariate (fitness times C_1) on endurance (Y)	-1.18**	.15	-1.48	-.89	-1.21**	.15	-1.50	-.92	-1.20**	1.5	-1.50	-.90	-1.16**	.15	-1.44	-.87
Indirect effects	Eff				Eff				Eff				Eff			
Activation	.12	.07	.02	.28	.08	.05	.01	.22	.10	.05	.01	.22	.09	.08	-.05	.26
Att. Control	-.04	.04	-.15	.03	-.04	.06	-.18	.06	-.01	.02	-.06	.01	-.04	.04	-.16	.02
Automaticity	.03	.06	-.08	.16	-.00	.06	-.14	.11	-.01	.04	-.10	.06	.01	.05	-.08	.11
Em Control	.03	.04	-.01	.14	.02	.03	-.01	.11	-.01	.02	-.07	.01	.02	.03	-.01	.11
Neg Thinking	.06	.04	.00[a]	.16	.01	.04	-.04	.10	-.02	.02	-.09	.03	.06	.04	-.00	.18
Total indirect effect	.20	.11	-.02	.42	.07	.12	-.16	.31	.05	.08	-.13	.21	.15	.11	-.07	.36

Note. B = unstandardized regression coefficients*;* Eff= Indirect effect of X on Y; LL=lower limit of 95% confidence interval; UL= upper limit of 95% confidence interval; SE = Standard Error; a = This number is .004 and, therefore is greater than 0 $p < .05$, ** $p < .001$;



Note: +ve indicates a positive association and –ve a negative association

Fig. 1. Specific mediational models and indirect effects