Psychology of Sport and Exercise 12 (2011) 184–191

Contents lists available at ScienceDirect

Psychology of Sport and Exercise

journal homepage: www.elsevier.com/locate/psychsport

Development and validation of a trait measure of robustness of self-confidence

Stuart Beattie*, Lew Hardy, Jennifer Savage, Tim Woodman, Nichola Callow

Bangor University, UK

ARTICLE INFO

Article history:
Received 1 March 2010
Received in revised form
15 September 2010
Accepted 23 September 2010
Available online 29 September 2010

Keywords:
Personality
Confidence
Robustness
Self-efficacy
resilience

ABSTRACT

Objectives: Robust confidence beliefs (the ability to maintain confidence beliefs in the face of adversity) have been highlighted as an important characteristic that contributes to the make up of mentally tough athletes. The purpose of the present set of studies was to develop such a measure.
Design: Three studies are reported that chart the development of a measure of Trait Robustness of Self-Confidence (i.e., the ability to maintain confidence in the face of disconfirming experiences).
Method: Study 1 developed a 12-item inventory that was subjected to single-factor confirmatory factor analysis used in an exploratory fashion.
Results: The factor structure of the resultant eight-item inventory (TROSCI) was consistent across both male and female athletes ($S{-}B\ \chi^2\ (20) = 29.75$; CFI = .98; RMSEA = .04; SRMR = .03). The single-factor structure of the eight-item inventory was confirmed in a second study that demonstrated structural ($S{-}B\ \chi^2\ (20) = 29.36$; CFI = .97; RMSEA = .05; SRMR = .04) and convergent validity ($S{-}B\ \chi^2\ (188) = 244.83$; CFI = .98; RMSEA = .05; SRMR = .06) with Vealey's TSCI. Finally, Study 3 demonstrated the predictive validity of TROSCI; high TROSC athletes were associated with more stable self-confidence levels prior to competition. Further, athletes with high TROSC levels managed to maintain higher state self-confidence levels than those with low TROSC levels.
Conclusions: Results support the view of robust confidence beliefs and highlight other factors that may play a moderating role.

It is a common notion amongst athletes, coaches, and sport practitioners that self-confidence is a fundamental requisite to sporting success. Research has demonstrated self-confidence to be one of the most influential cognitive determinants of athletic performance (Craft, Magyar, Becker, & Feltz, 2003; Moritz, Feltz, Fahrbach, & Mack, 2000; Woodman & Hardy, 2003). Although a vast amount of research has examined how confidence is developed and its relationship with a host of behavioral outcomes (see Bandura, 1997), an athlete's ability to maintain self-confidence beliefs (i.e., robust beliefs) through difficult and sometimes disconfirming experiences, has received limited research. Further, robust self-confidence beliefs have been linked to aspects of mental toughness (e.g., Bull, Shambrook, James, & Brooks, 2005; Jones, Hanton, & Connaughton, 2002). Bull et al. (2005) reported that 'resilient' self-confidence (a type of confidence that is hard to undermine) and 'robust' self-confidence (overcoming self-doubts, "feeding" off physical preparation, and maintaining self-focus) were characteristics of mental toughness reported by elite English cricketers. Further, having an unshakeable sense of self-belief and bouncing back from adversity has also been reported to be an important characteristic of professional athletes (Galli & Vealey, 2008; Jones, Hanton, & Connaughton, 2007).

From a social cognitive standpoint, Bandura (1997) suggested that firmly established self-efficacy beliefs (a situation-specific form of self-confidence) are resilient to adversity. Bandura (1977) proposed that efficacy beliefs vary on three dimensions that have important performance implications, namely, level, generality, and strength. *Level* of self-efficacy refers to the amount of task demands that performers believe they are capable of meeting. *Generality* of self-efficacy refers to the degree to which personal efficacy beliefs might be generalized across a range of tasks or situations. Finally, *strength* of self-efficacy refers to the extent to which self-efficacy beliefs can be maintained in the face of obstacles and disconfirming experiences; for example, Bandura (1997) stated, "weak efficacy beliefs are easily negated by disconfirming experiences, whereas people who have a tenacious belief in their capabilities will persevere in their efforts despite innumerable difficulties and obstacles" (p. 43). Bandura's standard methodology for measuring self-efficacy is to first ask individuals to rate the level of a task demand that they believe they are able to meet. By having (say) 10 levels of task demand, this method provides a measure of level of self-efficacy. To

* Corresponding author. School of Sport, Health, and Exercise Sciences, Bangor University, Gwynedd LL57 2DG, UK. Tel.: +44 (0) 1248 382 756; fax: +44 (0) 1248 371 053.
E-mail address: s.j.beattie@bangor.ac.uk (S. Beattie).

1469-0292/$ – see front matter © 2010 Elsevier Ltd. All rights reserved.
doi:10.1016/j.psychsport.2010.09.008

measure strength of self-efficacy, Bandura typically asks individuals to rate 'the strength of their beliefs on a 100 point scale, ranging in 10-unit intervals from 0 ("Cannot do"); through intermediate degrees of assurance, 50 ("Moderately certain can do"); to complete assurance, 100 ("Certain can do")' (Bandura, 1997; pp. 43–44). Strength scores are usually summed and divided by the total number of items. Generality of efficacy is usually dealt with by developing different scales for different tasks and/or situations. Lee and Bobko (1994) demonstrated that larger effect sizes are obtained from using a combined measure of Bandura's level and strength, than from using either dimension separately, thereby confirming that strength of efficacy (as measured by Bandura's standard methodology) is an important contributor to self-efficacy effects.

Bandura (1977, 1986, 1997) has developed an important theory, proposed operationalizations of his constructs, and demonstrated that these operationalizations predict performance (or, more broadly, behavior). Nevertheless, there remains a problem with Bandura's measurement of efficacy strength with regard to resilience. That is, Bandura measures the levels of certainty that individuals have in their abilities to meet different situational task demands. Although this certainty regarding self-efficacy is undoubtedly related to the ability to maintain efficacy beliefs in the face of disconfirming experiences, Bandura's measure of self-efficacy does not actually measure this construct. Consequently, there remains a need for a measure of *robustness*. The present paper aims to bridge this gap.

It is likely that the ability to maintain self-confidence despite disconfirming experiences would be a trait-like characteristic i.e., behaviors are stable over time (e.g., Fleeson, 2007). One other self-confidence model that incorporates trait self-confidence is Vealey's (1986) model of sport confidence. This model predicts that trait (dispositional) sport confidence and goal orientations (e.g., performance and outcome goals) interact to determine state sport confidence, which in turn influences performance. Vealey's approach and self-efficacy theory differ however, in that the former works at a fixed level of generality (the sport in which the individual is involved) but do not consider the specificity-generality issue any further. A second important distinction is that Vealey's approach does not consider robustness of confidence beliefs. Nevertheless, recent qualitative work by Galli and Vealey (2008) has started to explore the nature of resiliency (bouncing back from adversity) in sport. Resiliency, as defined by Galli and Vealey, clearly relates to at least part of Bandura's notion of efficacy strength – the part concerned with recovery of efficacy after its loss. Further, Galli and Vealey's work does not consider the other half of Bandura's notion of efficacy strength – the ability to maintain efficacy levels in the face of disconfirming experiences.

In light of the above discussion, the present authors contend than an important lacuna in the literature is a valid measure of the robustness of self-confidence. As well as having been shown to be an important component of mental toughness (cf., Clough, Earle, & Sewell, 2002; Gould, Hodge, Peterson, & Petlichkoff, 1987; Jones et al., 2002), robustness of self-confidence may contribute to performance over and above the contribution of level of self-confidence (cf. Bandura, 1997). The present paper presents a series of studies reporting the development and validation of a trait measure of robustness of self-confidence for use in competitive settings.

Study 1

Participants and measures

The participants were 268 (148 male; 120 female) white University athletes from the UK who participated in the following sports: swimming (10), running (8), cycling (3), netball (16), football (84), rugby (70), hockey (44), squash (4), badminton (18) and rowing (11). The mean age of the participants was 19.2 years (SD = 5.05) and had been playing their respective sport for 6.42 years (SD = 3.13).

Table 1
The Trait Robustness of Self-Confidence Inventory used in Study 1.

1) A bad result in competition has a very negative effect on my self-confidence.
2) My self-confidence goes up and down a lot.
3) Negative feedback from others does not affect my level of self-confidence.
4) Mistakes have very little effect on my self-confidence.
5) My self-confidence recovers very quickly after negative feedback from my coach or significant others.
6) I recover my self-confidence quickly after a bad result in competition.
7) If I perform poorly, my confidence is not badly affected.
8) My self-confidence is stable; it does not vary much at all.
9) My self-confidence is not greatly affected by the outcome of competition.
10) If I make a mistake it has quite a large detrimental effect on my self-confidence.
11) My self-confidence remains stable regardless of fluctuations in fitness level.
12) I recover my self-confidence very quickly if I make a mistake.

Trait Robustness of Self-Confidence Inventory

Based on Bandura's (1997) conception of robustness and qualitative research (e.g., Bull et al., 2005; Jones et al., 2002), items for the Trait Robustness of Self-Confidence Inventory (TROSCI) were generated by the second author and two sport psychology research assistants. Consensus was reached on 12 items which were retained for subsequent use in the inventory. Athletes were asked to rate the extent to that they agreed or disagreed with each statement on a Likert-type scale ranging from 1 (*strongly disagree*) to 9 (*strongly agree*). Standard anti social-desirability instructions encouraging participants to respond honestly were included at the beginning of the inventory (see Table 1 for items).

Procedure

After ethical approval, coaches of the teams from which the athletes were obtained were first contacted by telephone to inform them of the nature of the study and seek their permission to approach athletes during a training session. Once permission had been obtained, participants were asked to complete informed consent forms and the TROSCI during a training session that was within 1 week of a competitive match.

Results

Confirmatory factor analysis (CFA) was used in an exploratory fashion to examine the factor structure of the TROSCI. Cut-off criteria were based on the recommendations of Hu and Bentler (1999) and Markland (2007). Initial inspection of the data revealed that the Mardia coefficient was significant (Kurtosis $z = 6.19$, $p < .001$) indicating that the data departed from multivariate normality. Therefore, the Sattora–Bentler (S–B) χ^2 statistic was used. Specifically, a model was considered a good fit to the data if the Sattora–Bentler (S–B) χ^2/df ratio was less than 2.00, the Comparative Fit Index (CFI) approached .95; the Root Mean Square Error of the Approximation (RMSEA) approached .05, and the Standardized Root Mean Square Residual (SRMR) was less than .08. Prelis 2.14 (Jöreskog & Sörbom, 2003) was used to generate a covariance matrix and Lisrel 8.54 (Jöreskog & Sörbom, 2003) was used to test the single-factor model. The fit statistics almost reached an acceptable level for the initial 12-item model (S–B χ^2 (54) = 115.00; CFI = .97; RMSEA = .07; SRMR = .05). To produce a good fit, post-hoc model modifications were carried out by examination of the standardized residuals, the modification indices for Theta-Delta (unique item variance), and theoretical considerations. This post-hoc analysis revealed that item

4 ('Mistakes have a very little effect on my self-confidence'), item 5 ('My self-confidence recovers very quickly after negative feedback from my coach or significant others'), item 6 ('I recover my self-confidence quickly after a bad result in competition'), and item 12 ('I recover my self-confidence very quickly if I make a mistake') were identified as having high standardized residuals and modification indices and were removed. The resulting eight-item model reached a very good level of fit $S{-}B\ \chi^2\ (20) = 29.75$; CFI = .98; RMSEA = .04; SRMR = .03 (see Fig. 1 for factor loadings). Mean and standard deviation for TROSCI score were 35.50 (SD = 10.82) and the internal consistency was .83. Because five of the TROSCI items are positively framed and three are negatively framed, a separate two-factor model was analyzed. The two-factor model reached a good level of fit, $S{-}B\ \chi^2\ (19) = 27.80$; CFI = .98; RMSEA = .04; SRMR = .03. The correlation between the two factors was −.95. A chi-square difference test failed to show significant fit improvement in the model.

Gender

To examine any possible gender differences separate analyses were conducted for males and females. Initial inspection of the data revealed that the Mardia coefficient was significant for both males and females (Kurtosis $z = 6.19$, $p < .001$; $z = 4.91$, $p < .001$) indicating that the data departed from multivariate normality. Therefore, the Sattora–Bentler ($S{-}B$) χ^2 statistic was used. Fit statistics were good for both males, $S{-}B\ \chi^2\ (20) = 19.91$; CFI = .99; RMSEA = .00; SRMR = .04; and females, $S{-}B\ \chi^2\ (20) = 25.92$; CFI = .97; RMSEA = .04; SRMR = .05. The mean and standard deviation for TROSCI was 36.56 ($SD = 10.63$) for males and 34.19 ($SD = 10.94$) for females. An independent t-test revealed no significant difference between gender $t(266) = 1.79$, $p > .05$. Cronbach's alpha reached .78 and .83 for males and females respectively.

Discussion

Study 1 found a good fit for an eight-item TROSCI across the sample which showed good fit for both genders. Interestingly, 3 of the 4 items that were removed were related to the recovery of self-confidence. This would support the robust nature of self-confidence rather than the resilient component. The aim of the next study was to confirm the factor structure of TROSCI in a separate sample and to further examine its structural and convergent validity. TROSCI was again subjected to structural validity via CFA. Convergent validity was tested in two ways. First, TROSCI scores were correlated with scores obtained from Vealey's (1986) Trait Sport-Confidence Inventory (TSCI). Second, a separate two-factor model was examined in which it was hypothesized that TROSCI and TSCI would separate into two factors.

Study 2

Method

Participants and measures

A separate sample of athletes to that of Study 1 participated in Study 2. The participants were 176 white male athletes who were of UK/Irish origin participated in the following sports: Gaelic football (69); football (40); lacrosse (16); cricket (7); hockey (24); and rugby (20). The mean age of participants was 20.44 years old (SD = 5.25) and had been playing their respective sport for 9.78 years (SD = 4.66). Further, 69.6% of the athletes played at county level or above. The remainder participated at University level.

Trait Robustness of Self-Confidence Inventory. The same eight-item TROSCI that was developed in Study 1 was used (see Table 2).

The Trait Sports Confidence Inventory (TSCI). The TSCI (Vealey, 1986) contains 13 items and is designed to assess how confident an athlete "generally" feels (e.g., item 7 reads "Compare your confidence in your *ability to achieve your competitive goals* to the most confident athlete you know"). Athletes are asked to compare their self-confidence to the most confident athlete they know. The items are measured on a 9-point Likert scale ranging from 1 (*low*) to 9 (*high*). Vealey (1986) demonstrated good internal consistency for the TSCI, $\alpha = .93$, and adequate concurrent validity. The internal consistency in the present sample TSCI was $\alpha = .96$. The TSCI was chosen as it is the only other validated trait measure of self-confidence.

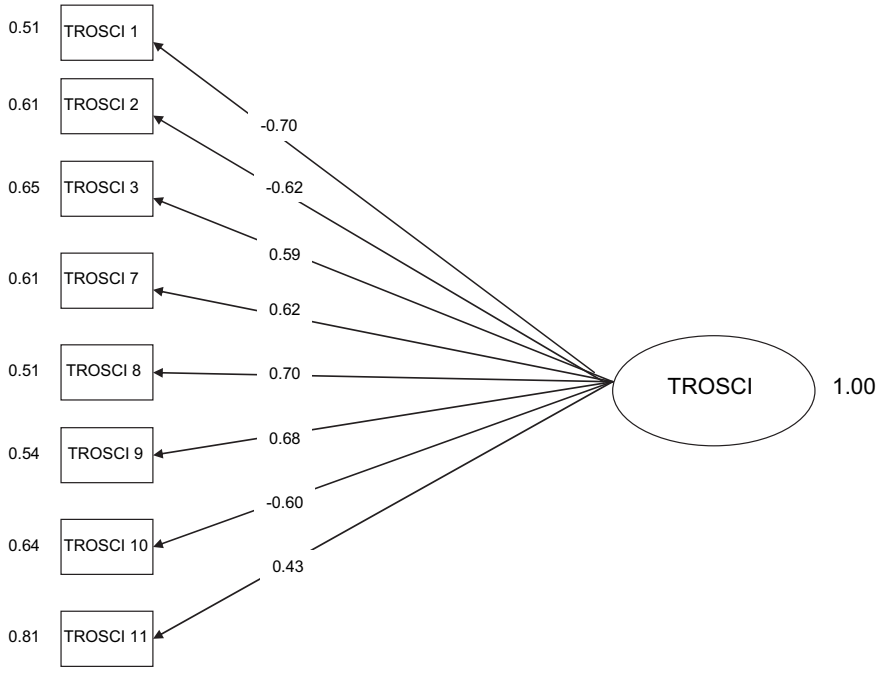

Fig. 1. Factor loadings and error terms for the single-factor CFA of TROSCI using the total (male and female) sample in Study 1.

Table 2
The eight confirmed TROSCI items used in Study 1. Items marked with an asterisk are reverse scored. Means (SD) are included for each item (after reverse scoring where appropriate).

Item	Mean (SD)
1) A bad result in competition has a very negative effect on my self-confidence.*	4.58 (2.19)
2) My self-confidence goes up and down a lot.*	4.32 (2.07)
3) Negative feedback from others does not affect my level of self-confidence.	3.88 (2.02)
4) If I perform poorly, my confidence is not badly affected.	4.22 (1.88)
5) My self-confidence is stable; it does not vary much at all.	4.51 (1.95)
6) My self-confidence is not greatly affected by the outcome of competition.	4.64 (1.98)
7) If I make a mistake it has quite a large detrimental effect on my self-confidence.*	4.71 (1.94)
8) My self-confidence remains stable regardless of fluctuations in fitness level.	4.61 (1.87)

Procedure

After ethical approval, coaches of the teams were first contacted by telephone to inform them of the nature of the study and to seek permission to approach the athletes during a training session. Once permission had been granted, athletes were approached a week before a competitive match and the nature of the study was explained to them. All consenting athletes were given a questionnaire pack containing informed consent forms, both questionnaires, and instructions. Athletes were asked to complete the TSCI and TROSCI 5 days before a competitive match. All packs were collected either in person by the third author or returned in a pre-paid envelope. A target sample of 250 athletes was obtained with a completion rate of 70%.

Results

Structural validity

To further validate TROSCI, confirmatory factor analysis was conducted on the whole sample of 176 athletes. The mean and standard deviation for TROSCI was 38.12 (SD = 10.89). Initial inspection of the data revealed that the Mardia coefficient was significant (Kurtosis $z = 3.09$, $p < .01$) indicating that the data departed from multivariate normality. Therefore, the Sattora–Bentler (S–B) χ^2 statistic was used. Results revealed a good fit; S–B χ^2 (20) = 29.36; CFI = .97; RMSEA = .05; SRMR = .04 (see Fig. 2 for factor loadings). The internal consistency of the eight-item TROSCI was $\alpha = .88$.

Convergent validity

158 athletes successfully completed both TROSCI and TSCI. A two-factor model was tested that included both TROSCI and TSCI. Results revealed a good fit for the two-factor model; S–B χ^2 (188) = 244.83; CFI = .98; RMSEA = .05; SRMR = .06. The correlation between the two factors was .44. No items cross-loaded.

Discussion

Study 2 again demonstrated good structural validity for the eight-item TROSCI in a separate sample of male athletes. Further, convergent validity was demonstrated in that CFA revealed that TROSCI and the TSCI were separate constructs. The aim of Study 3 was to examine the test–re-test reliability and the predictive validity of TROSCI. We hypothesized that TROSCI should show a high intra-individual correlation over time (i.e., test–re-test reliability). Predictive validity would be shown if athletes with high TROSC showed significantly less variance in their self-confidence prior to a competition than their low TROSC counterparts. Finally, according to mental toughness research (Bull et al., 2005; Jones et al., 2002) and self-efficacy theory (Bandura, 1997) when faced with disconfirming experiences, an interaction should occur where athletes high in TROSC should maintain high levels of state self-confidence whereas athletes low in TROSC should be more negatively affected by poor performance/disconfirming experience.

Study 3

Method

Out of 158 athletes from Study 2, 103 agreed to partake in Study 3. The participants were from the following sports: Gaelic football (49),

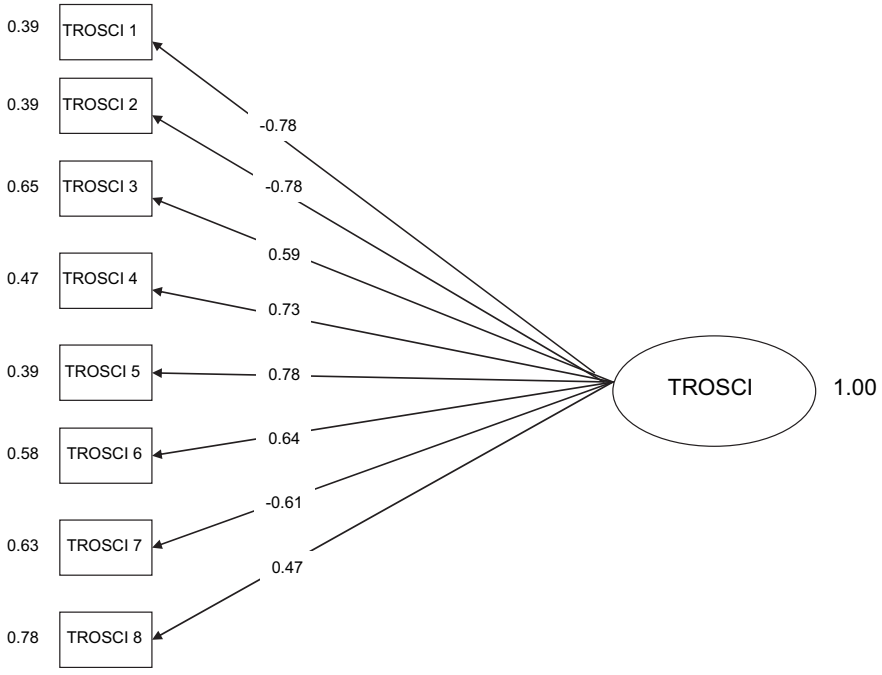

Fig. 2. Factor loadings and error terms for the single-factor CFA of TROSCI in Study 2.

football (26), lacrosse (3), cricket (1), hockey (11), and rugby (13). The mean age of the participants was 20.3 years old (SD = 5.00) and had been playing their respective sport for 10.42 years (SD = 5.36). Further, 77.6% of the athletes played at county level or above. The remainder participated at University level.

Self-Assessed Performance

The existence, or otherwise, of a disconfirming experience was assessed by asking the athletes, "Compared with how well you have normally performed and with regards to the quality of the opposition in the game you have just played, did you…", they were then asked to rate their performance on a seven-point Likert scale from −3 (*perform much worse than usual*), through 0 (*perform normally*), to +3 (*perform much better than usual*).

State Sports Confidence Inventory (SSCI)

Vealey's (1986) SSCI was used to measure state sport confidence. The inventory contains the same 13 items as the TSCI and athletes are asked to compare their self-confidence to the most confident athlete they know. The items are measured on a nine-point Likert scale ranging from 1 (*low*) to 9 (*high*). Vealey (1986) demonstrated good internal consistency for the SSCI, $\alpha = .95$, and adequate concurrent validity. Nevertheless, asking athletes to rate their self-confidence relative to the most confident athlete they know is problematic because this approach ignores some potentially important aspects of the self, notably within-self-comparisons (Beattie, Hardy, & Woodman, 2004; see also Short & Vadocz, 2002). Consequently, athletes in the present study were asked to rate their confidence relative to "the most confident you have ever felt". The internal consistency of the SSCI was $\alpha = .94$ for the present sample.

Procedure

All consenting athletes were given a questionnaire diary containing informed consent forms, all questionnaires, and instructions. The diary asked athletes to complete TROSCI, SSCI, and TSCI 5 days before a competition; the SSCI 3 days, 1 day, and 1 h before the competition. Approximately 1 h after the competition, participants completed another SSCI and the Self-Assessed Performance scale. Finally, 2 days after the competition participants completed TROSCI and the SSCI again. All diaries were returned in a confidential pre-paid envelope.

Results

Test–re-test reliability

The mean TROSCI score for this sub-sample was 34.36 (SD = 11.87) at Time 1 and 34.00 (SD = 10.55) at Time 2. The one-week test–re-test reliability for the TROSCI revealed a high interclass correlation ($\alpha = .90$). The SSCI over the 6 time periods also showed high reliability ($\alpha = .91$).

Predictive validity

To explore the first predictive validity hypothesis that athletes with high robust confidence beliefs would have low variability (low fluctuations) in SC-state over time whereas low robust confident athletes would show high variability (high fluctuations) in SC-state over time, within-person variability was analyzed. To test intra-individual variability across time, a within-person Standard Deviation (SD) of self-confidence scores across the four pre-performance time points was calculated and used as a variability dependent variable. A significant negative correlation of $r = -.37$ ($p < .001$) occurred between TROSCI (measured at Time 1) and self-confidence variability, showing that high TROSCI scores were related to lower confidence variability.

Table 3
Two-way moderated hierarchical regression analysis showing the interaction between Match performance and TROSC upon self-confidence.

Variables entered	R^2	R^2_{cha}	F_{cha}	*df*	β	*SE*	*t*
Model 1							
Pre-match confidence	.365	.365	58.04	1, 101	.582	.062	7.06***
Model 2							
Pre-match confidence					.483	.062	7.83***
Experience					.503	.061	8.31***
TROSC	.637	.272	37.12	1, 99	.129	.060	2.15*
Model 3							
Constant					.041	.056	0.73
Pre-match confidence					.437	.062	7.06***
Experience					.461	.061	7.60***
TROSC					.151	.058	2.58**
TROSC × Experience	.664	.027	7.84	1, 98	−.176	.063	−2.80**

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

Moderated hierarchical regression was used to examine the hypothesized interaction that athletes high in TROSC should maintain high levels of state self-confidence regardless of game performance whereas, athletes low in TROSC should be more adversely affected by self-evaluated poor performance. Pre-match state self-confidence was used as a covariate. The variables were entered in the following order: (1) Pre-match self-confidence; (2) Performance and TROSC; and (3) Performance × TROSC. Post-match self-confidence (i.e., measured 1 h after competing) was used as the dependant variable. Pre-match self-confidence significantly accounted for 36.5% of post-match self-confidence ($R^2 = .37$, $F(1, 101) = 58.04$, $p = .00$). Performance and TROSC significantly predicted post-match self-confidence over and above pre-match self-confidence, $R^2_{cha} = .27$, $F(1, 99) = 37.12$, $p = .00$. More importantly, the cross-product term (Performance × TROSC) significantly predicted variance in post-match self-confidence over and above the main effects $R^2_{cha} = .03$, $F(1, 98) = 7.84$, $p < .01$ (see Table 3 and Fig. 3). Fig. 3 shows that when TROSC is high, post-match self-confidence is generally unaffected by poor performance (i.e., self-confidence levels stay relatively stable regardless of how they performed). When TROSC is low, post-match self-confidence is significantly more negatively affected by poor performance (i.e., self-confidence levels were much more adversely affected by poor performance). As a further point of interest, when self-confidence measured 2 days post-competition was used as the dependent variable, the nature of the interaction was almost identical to that of when 1 h post-match self-confidence was entered ($R^2_{cha} = .031$, $F(1, 98) = 10.51$, $p = .002$). Further, when 1 hour post-match self-

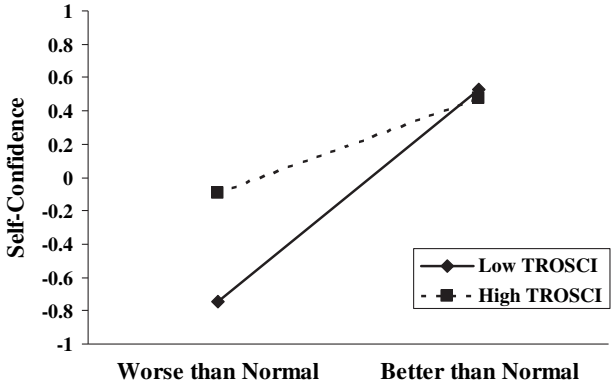

Fig. 3. Interaction between high and low TROSCI groups before and after poor performance.

confidence was also used as a covariate (as well as pre-match confidence), the interaction approached significance $R^2_{cha} = .007$, $F(1, 97) = 3.59$, $p = .06$. The nature of the interaction showed that self-confidence in both TROSC condition had recovered, but less so in the low TROSC condition.

Discussion

Results confirmed the test–re-test reliability and the predictive validity of TROSCI. Furthermore, the hypothesized interaction between TROSC and performance upon post-match state self-confidence was confirmed.

General discussion

The purpose of the present research was to address an important gap in previous research by developing and validating a Trait Robustness of Self-Confidence Inventory (TROSCI). Study 1 identified a single-factor structure for an eight-item inventory using a sample of male and female athletes. Furthermore, Study 2 confirmed the factor structure on an independent sample, and showed satisfactory internal consistency and convergent validity with Vealey's (1986) TSCI. Finally, Study 3 showed good test–re-test reliability of TROSCI and that high TROSCI scores were related to lower intra-individual variability in state self-confidence as the competitive match approached. Finally, moderated hierarchical regression analysis revealed that high levels of TROSC (compared to low TROSC) predicted smaller losses in self-confidence following disconfirming experiences.

Although the importance of resilient confidence beliefs have been widely noted in the research literature (Bandura, 1997; Bull et al., 2005; Galli & Vealey, 2008; Jones et al., 2002, 2007), no previous measurement of such beliefs existed. Although Bandura's (1997) self-efficacy theory has suggested that such a 'resilient' relationship exists through the conceptualization of 'strength of efficacy beliefs', this conception has been used as a situational variable (e.g., 'I am confident I can perform at a certain level') and is generally regressed with behaviors over various points in time (e.g., Devins & Edwards, 1988). Nevertheless, this conceptualization is not a measure of resilient beliefs. The current study does seem to support Bandura's (1997) notion that "efficacy beliefs that are firmly established…are resilient to adversity and are changeable only through compelling disconfirming experiences" (p. 68). In the current study, not only were high TROSC beliefs associated with lower intra-individual variability in state self-confidence over time, but they also protected the individual's state confidence from potentially debilitating disconfirming experiences.

The interaction between robustness of self-confidence and disconfirming experiences upon self-confidence also provides direct empirical support for the mental toughness literature where resilient and robust confidence beliefs have been highlighted as important variables (e.g., Bull et al., 2005; Jones et al., 2002). Bull et al. found that mentally tough athletes not only possessed high levels of self-confidence, but they possessed confidence levels that were hard to undermine. The current study provides a quantitative measure that can be used to tap this aspect of mental toughness. Further, in Study 3, the interaction between Performance and TROSC on self-confidence measured 1 h after a competitive match was almost identical to the interaction that emerged when self-confidence 2 days after the match was entered as the dependent variable. This finding would indicate that individuals low in TROSC did not make any recovery in terms of their self-confidence levels 2 days after the disconfirming experience. Therefore, there was no quick recovery in confidence levels. Future research should extend these findings and consider a longer time frame when examining the recovery of self-confidence beliefs. Practitioners should also consider intervention strategies that would enable a quicker recovery of confidence beliefs once they have dropped.

Other variables such as personality types may also influence the maintenance or recovery times of self-confidence beliefs. For example, research has shown that pessimists are more likely to rationalize bad events as their fault and presume it will affect their next event (Martin-Krumm, Sarrazin, Peterson, & Famose, 2001). Conversely, optimists are more likely to blame external factors for negative events and consequently are more likely to show stable beliefs over time (Peterson & Park, 1998). Additionally, narcissists are characterized with a pervasive pattern of grandiosity, self-focus, and self-importance (American Psychiatric Association, 1994). Narcissists typically find ways of discounting negative feedback, augmenting positive feedback and tend to reconstruct and enhance their past experiences to a more favorable occurrence (Morf & Rhodewalt, 1993). This view would initially suggest that narcissists would report high levels of robustness of self-confidence.

The current study only observed the maintenance of self-confidence after a disconfirming experience. Nevertheless, other behavioral variables have been linked to strong efficacy beliefs. For example, self-efficacy research has shown that high efficacy beliefs are related to goal commitment (Locke, Frederick, Lee, & Bobko, 1984; Locke & Latham, 1990); intensify efforts when accomplishments fall short of aspirations (Peake & Cervone, 1989); increase on-task effort (Bandura & Cervone, 1983); and show higher levels of task engagement (Caraway, Tucker, Reinke, & Hall, 2003; Walker, Greene, & Mansell, 2006). Mental toughness research has also been linked to higher levels of performance (e.g., Clough et al., 2002; Crust & Clough, 2005; Gucciardi, Gordon, & Dimmock, 2008). Therefore, future research may also consider such observations in relation to TROSC.

One interesting question that emerges from the studies reported in this paper is how robust confidence beliefs are developed. Bandura (1997) suggested that robust self-efficacy beliefs are "achieved largely through *carefully graded* [our italics] mastery experiences" (p. 397). It appears that the role of the coach has important implications for the development of such beliefs. Some researchers argue that mental toughness is a trait characteristic (Clough et al., 2002; Golby, Sheared, & Lavallee, 2006) and others argue that building resilient beliefs is a gradual process that involves multiple shifts in thought (Galli & Vealey, 2008). In any case, coaches who create performance environments that are poorly structured are unlikely to develop robust confidence beliefs in their athletes.

Limitations of the study include that we did not record whether individuals within teams had the home advantage or not. For example, research has shown that teams with home advantage tend to report higher levels of pre-match self-efficacy and confidence (Bray, Jones, & Owen, 2002). Importantly, when a team experiences a poor run of form at home (and home fans display their anger), robust confidence may become very important indeed. Further, social support from teammates may also help buffer some of the negative effects of poor performance that individual sport players may not receive. Other limitations of this study include the evaluation of disconfirming experiences. Disconfirming experiences were assessed by athletes rating their individual performance on a single item scale. Future research should include a wider range of adversity experiences and more detailed assessment of that adversity. Furthermore, Vealey's (1986) TSCI may not have been the most parsimonious measure for validating TROSCI. For example, the stem that Vealey uses in the TSCI ("compare your confidence to the most self-confident athlete you know") can create high inter-individual confidence variability depending on the skill level that the athletes are comparing themselves (Feltz & Chase, 1998; Schultz & Short, 2006). However, the TSCI is the only other validated measure of trait self-confidence.

To summarize, the present series of studies validated a trait measure of robustness of self-confidence. TROSCI provides researchers in mental toughness with a theoretically sound quantitative measure of robust/resilient confidence beliefs. TROSCI also shows good predictive validity where athletes with robust/resilient confidence beliefs are resilient to adversity (Bandura, 1977).

Author note

The authors would like to thank Mark Hobson, Sarah Fenwick, Sholto Radford, and Sarah Maulin, for their help with data collections.

Appendix

Trait Robustness of Sports-Confidence Inventory (TROSCI)

Name……
Age……Email address……..……...
Sport…….Team Name……
Years of competitive experience……..Date…….....….....

Please read the instructions carefully before responding to the statements.

Think about your confidence and how your performance may affect your confidence ***generally.***

The statements below describe how you may feel ***generally*** about your confidence, answer each statement by circling the number that corresponds to how strongly you agree or disagree **generally**. Please try and respond to each item separately.

The terms ***competition*** refers to matches, tournaments or other competitive events.

Please answer the items as honestly and accurately as possible there are no right or wrong answers. Your response will be kept confidential.

	Strongly Disagree				Neutral				Strongly Agree
1. A bad result in competition has a very negative effect on my self-confidence.	1	2	3	4	5	6	7	8	9
2. My self-confidence goes up and down a lot.	1	2	3	4	5	6	7	8	9
3. Negative feedback from others does not affect my level of self-confidence.	1	2	3	4	5	6	7	8	9
4. If I perform poorly, my confidence is not badly affected.	1	2	3	4	5	6	7	8	9
5. My self-confidence is stable; it does not vary very much at all.	1	2	3	4	5	6	7	8	9
6. My self-confidence is not greatly affected by the outcome of competition.	1	2	3	4	5	6	7	8	9
7. If I make a mistake it has quite a large detrimental effect on my self-confidence.	1	2	3	4	5	6	7	8	9
8. My self-confidence remains stable regardless of fluctuations in fitness level.	1	2	3	4	5	6	7	8	9

References

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.

Bandura, A. (1977). Self-efficacy. Toward a unifying theory of behavioural change. *Psychological Review, 84*, 191–215.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.

Bandura, A. (1997). *Self-efficacy*. New York: Freeman.

Bandura, A., & Cervone, D. (1983). Self-evaluative and self-efficacy mechanisms governing the motivational effects of goal systems. *Journal of Personality and Social Psychology, 45*, 1017–1028.

Beattie, S., Hardy, L., & Woodman, T. (2004). Precompetition self-confidence: the role of the self. *Journal of Sport & Exercise Psychology, 26*, 427–441.

Bull, S. J., Shambrook, C. J., James, W., & Brooks, J. E. (2005). Towards an understanding of mental toughness in elite English cricketers. *Journal of Applied Sport Psychology, 17*, 209–277.

Bray, S. R., Jones, M. V., & Owen, S. (2002). The influence of competition location on athletes' psychological states. *Journal of Sport Behavior, 25*, 231–242.

Caraway, K., Tucker, C. M., Reinke, W. M., & Hall, C. (2003). Self-efficacy, goal orientation, and fear of failure as predictors of school engagement in high school students. *Psychology in the Schools, 40*, 417–427.

Clough, P. J., Earle, K., & Sewell, D. (2002). Mental toughness: the concept and its measurement. In I. Cockerill (Ed.), *Solutions in sport psychology* (pp. 32–43). London: Thomson.

Craft, L. L., Magyar, T. M., Becker, B. J., & Feltz, D. L. (2003). The relationship between the Competitive State Anxiety Inventory-2 and sport performance: a meta-analysis. *Journal of Sport & Exercise Psychology, 25*, 44–65.

Crust, L., & Clough, P. J. (2005). Relationship between mental toughness and physical endurance. *Perceptual and Motor Skills, 100*, 192–194.

Devins, G. M., & Edwards, P. J. (1988). Self-efficacy and smoking reduction in chronic obstructive pulmonary disease. *Behaviour Research Therapy, 26*, 127–135.

Feltz, D. L., & Chase, M. A. (1998). The measurement of self-efficacy and confidence in sport. In J. L. Duda (Ed.), *Advances in sport and exercise psychology measurement* (pp. 65–80). Morgantown, WV: Fitness Information Technology.

Fleeson, W. (2007). Situation-based contingencies underlying trait-content manifestation in behaviour. *Journal of Personality, 75*, 825–861.

Galli, N., & Vealey, R. S. (2008). Bouncing back from adversity: athletes' experiences of resilience. *The Sport Psychologist, 22*, 316–335.

Gould, D., Hodge, K., Peterson, K., & Petlichkoff, L. (1987). Psychological foundations of coaching: similarities and differences among intercollegiate wrestling coaches. *The Sport Psychologist, 1*, 293–308.

Gucciardi, D. F., Gordon, S., & Dimmock, J. A. (2008). Evaluation of a mental toughness training program for youth-aged Australian footballers: I. A quantitative analysis. *Journal of Applied Sport Psychology, 21*, 307–323.

Golby, J., Sheard, M., & Lavallee, D. (2003). A cognitive–behavioural analysis of mental toughness in national rugby league teams. *Perceptual and Motor Skills, 96*, 455–462.

Hu, L., & Bentler, P. M. (1999). Cut-off criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Structural Equation Modelling, 6*, 1–55.

Jones, G., Hanton, S., & Connaughton, D. (2002). What is this thing called mental toughness? An investigation of elite performers. *Journal of Applied Sport Psychology, 14*, 205–218.

Jones, G., Hanton, S., & Connaughton, D. (2007). A framework of mental toughness in the world's best performers. *The Sport Psychologist, 21*, 243–264.

Jöreskog, K. G., & Sörbom, D. (2003). *LISREL 8.54*. Lincolnwood, IL: Scientific Software International, Inc.

Lee, C., & Bobko, P. (1994). Self-efficacy beliefs: comparison of five measures. *Journal of Applied Psychology, 79*, 364–369.

Locke, E. A., Frederick, E., Lee, C., & Bobko, P. (1984). Effect of self-efficacy, goals, and task strategies on task performance. *Journal of Applied Psychology, 69*, 241–251.

Locke, E. A., & Latham, G. P. (1990). *A theory of goal setting and task performance*. Englewood Cliffs, NJ: Prentice-Hall.

Markland, D. (2007). The golden rule is that there are no golden rules: a commentary on Paul Barrett's recommendations for reporting model fit in structural equation modeling. *Personality and Individual Differences, 42*, 519–530.

Martin-Krumm, C., Sarrazin, P., Peterson, C., & Famose, J. P. (2001). Explanatory style and resilience after sports failure. *Personality and Individual Differences, 35*, 1685–1695.

Morf, C. C., & Rhodewalt, F. (1993). Narcissism and self-evaluation maintenance: explorations in object relations. *Personality and Social Psychology Bulletin, 19*, 668–676.

Moritz, S. E., Feltz, D. L., Fahrbach, K. R., & Mack, D. E. (2000). The relationship of self-efficacy measures to sport performance: a meta-analytical review. *Research Quarterly for Exercise and Sport, 71*, 280–294.

Peterson, C., & Park, C. (1998). Learned helplessness and explanatory style. In D. F. Barone, V. B. Van Hasselt, & M. Hersen (Eds.), *Advanced personality* (pp. 287–310). New York: Plenum.

Peake, P. K., & Cervone, D. (1989). Sequence anchoring and self-efficacy: primacy effects in the consideration of possibilities. *Social Cognition, 7*, 31–50.

Schultz, R., & Short, S. E. (2006). Who do athletes compare to: how the standard of comparison affects confidence ratings. In *AAASP conference proceedings* (pp. 82–83).

Short, S. E., & Vadocz, E. A. (2002). Testing the modifiability of the state sport confidence inventory. *Perceptual and Motor Skills, 94*, 1025–1028.

Vealey, R. S. (1986). Conceptualization of sport confidence and competitive orientation: preliminary investigation and instrument development. *Journal of Sport Psychology, 8*, 221–246.

Walker, C. O., Greene, B. A., & Mansell, R. A. (2006). Identification with academics, intrinsic/extrinsic motivation, and self-efficacy as predictors of cognitive engagement. *Learning and Individual Differences, 16*, 1–12.

Woodman, T., & Hardy, L. (2003). The relative impact of cognitive anxiety and self-confidence upon sport performance: a meta-analysis. *Journal of Sports Sciences, 21*, 443–457.