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Test-retest reliability of the irrational performance beliefs inventory (iPBI).

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## 1 Abstract

2 The irrational performance beliefs inventory (iPBI) was developed to measure irrational  
3 beliefs within performance domains such as sport, academia, business, and the military. Past  
4 research indicates that the iPBI has good construct, concurrent, and predictive validity, but  
5 the test-retest reliability of the iPBI has not yet been examined. Therefore, in the present  
6 study the iPBI was administered to university sport and exercise students ( $n = 160$ ) and  
7 academy soccer athletes ( $n = 75$ ) at three time points. Time point two occurred seven days  
8 after time point one, and time point three occurred twenty-one days after time point two. In  
9 addition, social desirability was also measured. Repeated-measures MANCOVAs, intra-class  
10 coefficients, and Pearson ( $r$ ) correlations demonstrate that the iPBI has good test-retest  
11 reliability, with iPBI scores remaining stable across the three time points. Pearson's  
12 correlation coefficients revealed no relationships between the iPBI and social desirability,  
13 indicating that the iPBI is not highly susceptible to response bias. The results are discussed  
14 with reference to the continued usage and development of the iPBI, and future research  
15 recommendations relating to the investigation of irrational performance beliefs are proposed.

16 Keywords: REBT; irrational beliefs; reliability; performance; response bias

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1           Test-retest reliability of the irrational performance beliefs inventory (iPBI).

2   Recent growth in the reported application of rational emotive behaviour therapy (REBT) in  
3   performance domains such as sport (Turner & Barker, 2014) and business (Turner & Barker,  
4   2015) has highlighted the need for a performance-specific measure of irrational beliefs.  
5   Recent recommendations assert that new measures should consider situational perceptions in  
6   assessing psychological constructs (Ziegler & Horstmann, 2015) and therefore the irrational  
7   performance beliefs inventory (iPBI; Turner et al., 2016), the first measure of irrational  
8   beliefs within performance domains, was developed and validated. The iPBI was developed  
9   as a brief (28-item) psychometric for use in performance domains such as sport, academia,  
10   business, and the military. Guided by recommendations for the development of irrational  
11   beliefs measures (Terjesen, Salhany, & Sciutto, 2009), and building on extant psychometrics,  
12   the iPBI reflects current manifestations of REBT theory and measures only beliefs, not  
13   emotional and or behavioural outcomes.

14           Consistent with contemporary REBT theory (e.g., Dryden, 2015), the iPBI measures  
15   the four core irrational beliefs with 7-items measuring primary beliefs (PIB), low-frustration  
16   tolerance (LFT), awfulizing (AWF), and depreciation (DEP). This is important because  
17   dysfunctional emotions (e.g., immobilizing emotions such as anxiety) and associated  
18   maladaptive behaviours (e.g., withdrawal) stem from irrational beliefs (e.g., Browne, Dowd,  
19   & Freeman, 2010; Szentagotai & Jones, 2010). Therefore, the ability to accurately measure  
20   irrational beliefs can help to identify risk factors for dysfunctional emotions and maladaptive  
21   behaviours, and assess REBT effectiveness in clients. The goal of REBT is to reduce  
22   irrational beliefs in favour of rational beliefs, and therefore the iPBI needs to be sensitive to  
23   detect changes, while also being reliable enough to mark stability in irrational beliefs. In  
24   research examining the use of REBT in sport, the Shortened General Attitudes and Beliefs  
25   Scale (SGABS; Lindner, Kirkby, Wertheim, & Birch, 1999) has typically been used to

1 measure irrational beliefs. However, the SGABS is limited because limited because it does  
2 not represent current manifestations of REBT, and specifically, does not produce results for  
3 the four core irrational beliefs. In addition, the SGABS is not context-specific, and therefore  
4 the rationale for developing the iPBI was driven by the need to more accurately assess the  
5 four core irrational beliefs in performance domains such as sport, academia, business, and the  
6 military (Turner et al., 2016).

7 Initial development and validation data for the iPBI (Turner et al., 2016) indicates  
8 construct, concurrent and predictive validity, however this primary data did not indicate test-  
9 retest reliability. Some consider test-retest reliability to be the most important type of  
10 reliability when considering the use of a test as an outcome measure (Law, 2004). Test-retest  
11 reliability indicates the reproducibility of the measure, and its ability to provide consistent  
12 scores over time in a stable population (Aaronson et al., 2002). A valid and reliable measure  
13 of irrational beliefs should demonstrate that scores remain stable over time, unless REBT has  
14 been applied, in which case scores should significantly decrease post-intervention. This is  
15 important because much of the research applying REBT interventions in sport adopts single-  
16 case designs (e.g., Barker, McCarthy, Jones, & Moran, 2011), where outcomes are measured  
17 repeatedly throughout baseline and intervention period, thus psychometrics need to be  
18 reliable on repeated assessment.

19 Further, the performance domain sampled in the initial validation of the iPBI included  
20 only occupational workers, and did not include academic and or athletic participants (Turner  
21 et al., 2016). It is important to progressively validate the iPBI in all of the intended  
22 performance domains to ensure that it is a reliable indicator of irrational performance beliefs  
23 across multiple performance domains. Two performance domains for which the iPBI was  
24 initially developed are academia and sport, and the authors were able to sample United  
25 Kingdom (U.K.) academy soccer athletes and U. K. university students for the current study.

1 Recent research has indicated that irrational beliefs positively predict increases in burnout in  
2 athletes over a season (Turner & Moore, 2016), and are positively related to negative affect,  
3 and negatively related to positive affect in university students (Allen, El-Cheikha, & Turner,  
4 2017). As such, testing the reliability of the iPBI in athlete and student samples is important  
5 in order to ensure contextual sensitivity of the recently developed measure. Therefore in the  
6 current study the test-retest reliability of the iPBI is examined in separate sport (soccer  
7 athletes) and academic (university students) samples, two of the performance domains for  
8 which the iPBI was designed. To be clear, we examine the test-retest reliability of the iPBI in  
9 two separate performance domains, namely an academy soccer athlete sample, and an  
10 academic student sample. The two samples are treated separately in the analyses in the  
11 current paper, but for brevity we show findings for both samples in the reporting the results.

12 The chief aim of the present study is to examine the test-retest reliability of the iPBI  
13 across three time points within a single calendar month, advancing the test-retest irrational  
14 beliefs research, where two time points just days apart is a more typical protocol (e.g.,  
15 Lindner et al., 1999). The secondary aim of the current study is to explore the social  
16 desirability of irrational beliefs. Social desirability is a key concern when considering the  
17 validity of scores produced via self-report psychometrics, which are inherently open to  
18 response bias (van de Mortel, 2008), and therefore affects the validity of a questionnaire  
19 (Huang, Liao, & Chang, 1998).

## 20 **Method**

### 21 **Participants**

22 Participants were university students enrolled on a sport and exercise science course  
23 ( $n = 160$ ,  $M_{age} = 20.79$ ;  $SD = 3.70$ ; first year of study = 119 students; second year of study =  
24 41 students; female = 33; male = 78;  $n = 49$  participants did not indicate their sex) and  
25 academy soccer athletes ( $n = 75$ ;  $M_{age} = 15.92$ ;  $SD = 1.74$ ; female = 33; male = 42). Students

1 were recruited from the sport and exercise department at a university in the U.K. Data were  
2 collected using convenience sampling, whereby students were accessed through a university  
3 lecturer who distributed the questionnaires on three separate occasions to their sport and  
4 exercise students. In their studies, students had not learned about irrational beliefs, or REBT.  
5 Academy soccer athletes were recruited from a Premier League Category 1 U.K. mens soccer  
6 academy, and from a U.K. womens Tier 2 Premier League regional talent club. For soccer  
7 athlete data, the clubs' sport psychologist distributed the questionnaires on three separate  
8 occasions. These samples were targeted because participants are required to perform on a  
9 regular basis, whether it is in exams and assessments (students), or competitive sport (soccer  
10 athletes), and the iPBI was developed to assess irrational beliefs within these performance  
11 domains. Ethical approval was granted by the university, and all participants completed  
12 informed and or minor (soccer athletes only) assent prior to any data collection. All data were  
13 collected using pen and paper questionnaires, within environments the participants were  
14 familiar with. That is, soccer athletes completed the questionnaires in a meeting room at the  
15 football club, while students completed the questionnaires in a lecture theatre.

## 16 **Measures**

17 **Irrational performance beliefs.** To assess the presence of irrational beliefs,  
18 participants completed the iPBI (Turner et al., 2016). The questionnaire is designed for usage  
19 in performance domains (such as sport or academia) and consists of 28-items, seven-items for  
20 each of its four subscales (PIB, LFT, AWF, and DEP). Scores from each subscale are  
21 summed to form a composite irrational performance beliefs score (COMP). Responses are  
22 made on a 5-point Likert-scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The  
23 iPBI has been shown to have good criterion, construct, and concurrent validity (Turner et al.,  
24 2016). For the current sample at first completion ( $N = 225$ ), Cronbach's  $\alpha$  were PIB = .63,  
25 LFT = .76, AWF = .76, DEP = .84, COMP = .87. Therefore, subscales demonstrated

1 acceptable to good internal consistency (Loewenthal, 2004). Further, data from all first  
2 completions showed that Mean subscale scores ( $MPIB = 24.61, SD = 2.69$ ;  $MLFT = 26.99,$   
3  $SD = 2.99$ ;  $MAWF = 22.83, SD = 3.42$ ;  $MDEP = 17.17, SD = 4.49$ ) were comparable to  
4 previous norms (Turner et al., 2016).

5       **Social desirability.** The brief social desirability scale (BSDS; Haghghat, 2007) was  
6 developed as a short social desirability scale for brevity and practicality, and has four  
7 questions. The BSDS was selected in the current study due to its usage in recent sport  
8 research (e.g., Kavussanua, Hatzigeorgiadisb, Elbec, & Ring, 2016). Participants were asked  
9 to respond to the four questions with a “yes” or a “no,” and a score of 1 was allocated to  
10 “yes” answers, and a score of 0 for “no” answers. Item four is reverse scored, because “no” is  
11 deemed to be the socially desirable answer. The BSDS is valid and reliable (Cronbach’s  $\alpha =$   
12  $.60$ ) and free from gender specificity.

### 13 **Procedures**

14       Participants completed questionnaires at three time points. The development of  
15 similar measures (e.g., SGABS; Lindner et al., 1999) has deemed test-retest reliability across  
16 two time points sufficient to make recall of previous answers more difficult. Guidelines  
17 suggest that test-retest validity should be assessed at least several days following first  
18 completion (Law, 2004). The current study employed a more robust method by making the  
19 duration between time points longer, including a third time point to assess more long-term  
20 test-retest reliability, and by recruiting a larger sample. Specifically, 107 participants  
21 completed all three time points ( $n_{students} = 52$ ;  $n_{athletes} = 55$ ). This number of participants  
22 is in line with some previous test-retest research for irrational beliefs measures (e.g., Lindner  
23 et al., 1999;  $n = 90$ ), and higher than recommended in guidelines, which advocates at least 30  
24 participants (Law, 2004). In addition, for a medium effect size ( $\eta^2 = .059$ ) to be detected  
25 using repeated measures analyses with sufficient power (.80), a sample size of  $n = 30$  was



1 required for each of the two samples (Clark-Carter, 2010). At time point 1, after indicating  
2 consent, participants completed the iPBI, the BSDS, and provided demographic information.  
3 Seven days after time point 1, time point 2 occurred, where participants completed the iPBI  
4 only. Time point 3 occurred 21 days after time point 2, and participants completed the iPBI  
5 for the final time, and received a full debrief as to the aims of the study.

## 6 **Analytic Strategy**

7         Prior to main data analyses, data underwent missing values analyses and were  
8 screened for outliers. Missing data analyses showed that data were missing completely at  
9 random (MCAR) for AWF,  $\chi^2(6) = 7.24, p = .30$ , and DEP,  $\chi^2(27) = 33.42, p = .18$ , at time  
10 point 1 only. Therefore, the expectation maximization (EM) technique was conducted to  
11 replace missing values in these data. To identify outliers, Shapiro Wilks tests were  
12 performed, and  $z$  scores inspected. Significant outliers with a  $z$  score of 2SDs were  
13 windzORIZED (Smith, 2011).

14         For main data analyses, the two samples (students and soccer athletes) were treated  
15 separately. Main data analyses were conducted in three stages. First, two repeated-measures  
16 MANCOVAs (one test for students, one test for soccer athletes) were performed, with age as  
17 the covariate, to examine changes in each iPBI subscale (PIB, LFT, AWF, DEP, and COMP)  
18 across the three time points. Age was included as a covariate because past research indicates  
19 a negative linear association between irrational beliefs and age (e.g., Turner et al., 2016). It  
20 was important to analyze the soccer athlete and student samples separately in this instance in  
21 order to distinguish changes over time for each participant group. Second, intra-class  
22 coefficients (ICC) and Pearson's correlation coefficients were calculated to examine the  
23 consistency of irrational beliefs scores across time points (e.g., Law, 2004).

1 Finally, two separate correlation analyses were performed for all first completions of  
2 the iPBI, one for the student data ( $n = 160$ ) and one for the soccer athlete data ( $n = 75$ ), to  
3 explore the relationships between irrational beliefs and social desirability.

#### 4 **Results**

##### 5 **Changes in irrational beliefs across the three time points.**

6 For soccer athlete data, the repeated measures MANCOVA revealed no effect for  
7 time, Wilk's  $\lambda = .77$ ,  $F(9,34) 1.15$ ,  $p > .05$ ,  $\eta^2 = .23$ . For student data, repeated measures  
8 MANCOVA revealed no effect for time, Wilk's  $\lambda = .91$ ,  $F(9,35) .39$ ,  $p > .05$ ,  $\eta^2 = .09$ .  
9 Further, follow-up univariate analyses revealed no significant effects ( $p > .05$ ) for time in any  
10 of the variables across the soccer athlete or student samples (Table 1). The removal of age as  
11 a covariate did not change the direction or non-significance of results. Inspection of the  
12 means demonstrates a consistency in scores in all iPBI variables across time points 1, 2, and  
13 3. ICC results (Table 1) and Pearson's correlation co-efficients (Table 2) for soccer athlete  
14 and student data revealed strong agreement across time points for all irrational performance  
15 beliefs variables.

##### 16 **Relationships between irrational beliefs and social desirability.**

17 Pearson's correlation coefficients (Table 3) conducted for each of the samples  
18 revealed no significant associations between social desirability and the iPBI subscales.

#### 19 **Discussion**

20 The current study had two main aims. First, the test-retest reliability of the iPBI was tested  
21 across three-time points in two separate samples that reflected the performance domains of  
22 academia (students) and sport (soccer athletes). Second, the relationship between iPBI scores  
23 and social desirability was examined, because social desirability can affect the validity of a  
24 questionnaire (Huang et al., 1998). Results indicate that the iPBI demonstrates good test-  
25 retest validity in both samples. Inferential statistics indicate that the four iPBI subscales, and

1 the composite scores, remained stable across the three time points in both soccer athlete and  
2 student samples. This is important because a reliable psychometric should provide consistent  
3 scores over time in a stable population (Aaronson et al., 2002). Further, iPBI scores were not  
4 related to social desirability scores. This study contributes significantly to the extant literature  
5 in several ways. First, this is the first study to examine the test-retest reliability of the iPBI.  
6 The finding that the iPBI is reliable on repeated administration across two separate samples  
7 and unrelated to social desirability, alongside past findings that the iPBI has construct,  
8 concurrent and predictive validity (Turner et al., 2016), establishes the iPBI as a sound  
9 measure of irrational performance beliefs. Second, to build on Turner et al's (2016) initial  
10 iPBI research, which recruited an occupational sample, the current study included both  
11 student and soccer athlete samples. This is important because the iPBI was developed for use  
12 across different performance domains, and therefore should be tested within various  
13 performance samples including sport and academia. Further, the demonstration of test-retest  
14 reliability of the iPBI in two separate samples enhances in the findings.

15 The main finding of the current paper that the iPBI demonstrates good test-retest  
16 reliability has implications for the use of the iPBI and the investigation of irrational beliefs  
17 and REBT in performance domains. Support for the test-retest reliability, alongside past  
18 research evidencing construct, concurrent, and predictive validity (Turner et al., 2016), of the  
19 iPBI means that researchers and practitioners can be more confident in using the iPBI to  
20 measure irrational performance beliefs. That is, administrators of the iPBI can be more  
21 certain that the iPBI is a valid and reliable measure that not only measures what it proposes to  
22 measure, but can also be used as part of an ongoing, repeated-measures, assessment of  
23 irrational beliefs. This is particularly valuable in sport and exercise psychology where single-  
24 case designs, with repeated markers of the dependent variables collected, are being used more  
25 prominently (e.g., Barker et al., 2011), thus requiring psychometrics that are reliable on

1 repeated assessment. Past research (e.g., Turner & Barker, 2013; 2015) shows that general  
2 irrational beliefs (using the SGABS; Lindner et al., 1999) can decrease at the onset of REBT  
3 in performance domains, and can return to baseline or remain stable depending on the  
4 number of REBT sessions provided to participants. This research could be strengthened with  
5 the use of a contextually valid measure of irrational performance beliefs such as the iPBI, and  
6 therefore the further development and validation of the iPBI is paramount.

7         Addressing the limitations of the current study would further and more rigorously  
8 assess the reliability of the iPBI. First, a broader range of athletes could be recruited across  
9 various sports and age groups. Indeed, research that has examined REBT in sport has mainly  
10 focussed on football and cricket, but there is a need to broaden the athlete sample base to gain  
11 a broader understanding of irrational beliefs, and the use of the iPBI in, for example,  
12 individual and team sports. Also, in relation to recruiting student samples, future research  
13 should address the large attrition in participants reported in the current study over the three  
14 time points. The nature of collecting data from students in an academic domain means that  
15 retaining all participants for repeated measures research is difficult. In the current study, we  
16 ensured that each time point happened at the same time in the day, which meant that if  
17 students were absent that day at that time, we could not record their data. Future research  
18 may consider using online survey tools to mitigate attrition, but researchers should be careful  
19 to ensure data is collected at consistent times for each time point. Future research should also  
20 collect data across multiple universities to broaden the student sample beyond a single  
21 institution, as this may benefit the generalizability of the findings. Second, given that the  
22 initial development and validation of the iPBI was conducted with an occupational sample, a  
23 test-retest assessment should take place within that sample too. Since the iPBI was developed  
24 for use across various performance domains, it is important to validate the measure across  
25 those settings (e.g., sport, business, military, and academia). It should be recognized that the

1 current study includes soccer athlete and student populations only. Third, because the iPBI is  
2 a new measure, additional CFA analyses should be conducted across different samples. In the  
3 current, CFA could have revealed challenges to the four-factor structure of the iPBI, and  
4 researchers should recruit sufficient samples ( $n > 200$ ; Myers, Ahn, & Jin, 2011) in order to  
5 confirm the four-factor structure of the iPBI. Finally, to understand how the iPBI scores react  
6 to REBT, a repeated-measures intervention design should be conducted. The current study  
7 shows that iPBI scores remain stable in a non-intervention situation, but it is not yet fully  
8 known how the iPBI reacts to REBT (e.g., Deen, Turner, & Wong, 2017) and whether and to  
9 what extent reductions in irrational beliefs, as expected, would occur.

10 In sum, results from this study demonstrate test-retest reliability of the iPBI in  
11 separate soccer athlete and student samples. This is the first study to assess the test-retest  
12 reliability of the iPBI, and builds on past research showing that the iPBI has good construct,  
13 concurrent, and predictive validity (Turner et al., 2016). Social desirability scores were not  
14 related to iPBI scores, suggesting that the iPBI is not highly susceptible to response bias.

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Table 1.

*Repeated-measures Univariate ANCOVA, intra-class coefficients, Means  $\pm$  SD for soccer athlete and student data across the three data collection timepoints.*

Variables	Time 1	Means $\pm$ SD		Athlete Data		Intra-class coefficients		
		Time 2 (7days)	Time 3 (30days)	ANCOVA F (df)	$\eta^2$	F (df)	ICC	95% CI
PIB	24.39 $\pm$ 2.87	23.78 $\pm$ 2.73	23.25 $\pm$ 2.55	$F(2,84) = .49$	.01	$F(54,108) = 7.21^*$	.85	.86-.91
LFT	26.82 $\pm$ 3.17	25.88 $\pm$ 3.46	25.78 $\pm$ 3.99	$F(2,84) = .15$	.01	$F(49,98) = 8.46^*$	.85	.80-.93
AWF	22.33 $\pm$ 3.61	22.22 $\pm$ 3.30	21.53 $\pm$ 3.05	$F(2,84) = 2.35$	.05	$F(50,100) = 8.46^*$	.88	.81-.93
DEP	16.75 $\pm$ 3.52	17.00 $\pm$ 3.22	17.75 $\pm$ 3.42	$F(2,84) = 2.50$	.06	$F(50,100) = 7.35^*$	.86	.77-.91
COMP	22.47 $\pm$ 2.70	21.99 $\pm$ 2.64	22.05 $\pm$ 2.28	$F(2,84) = 1.70$	.04	$F(43,86) = 12.27^*$	.92	.86-.95

  

Variables	Time 1	Means $\pm$ SD		Student Data		Intra-class coefficients		
		Time 2 (7days)	Time 3 (30days)	ANCOVA F (df)	$\eta^2$	F (df)	ICC	95% CI
PIB	24.63 $\pm$ 3.23	24.23 $\pm$ 3.95	24.31 $\pm$ 3.13	$F(2,100) = .29$	.01	$F(51,102) = 8.75^*$	.89	.82-.93
LFT	27.07 $\pm$ 3.40	26.20 $\pm$ 3.69	26.02 $\pm$ 4.41	$F(2,98) = .60$	.01	$F(50,100) = 4.65^*$	.78	.65-.87
AWF	22.07 $\pm$ 4.01	22.15 $\pm$ 4.02	22.08 $\pm$ 3.94	$F(2,92) = .18$	.01	$F(47,94) = 7.17^*$	.86	.78-.92
DEP	17.11 $\pm$ 5.36	16.62 $\pm$ 5.45	17.79 $\pm$ 4.68	$F(2,100) = .13$	.01	$F(51,102) = 7.95^*$	.87	.80-.92
COMP	22.76 $\pm$ 3.00	22.33 $\pm$ 3.69	22.40 $\pm$ 3.35	$F(2,86) = .02$	<.01	$F(44,88) = 9.78^*$	.90	.83-.94

Note. \* $p < .001$





Table 3.

*Pearson's correlation coefficients (r) for irrational performance beliefs, perceived helpfulness of beliefs and social desirability, for the first completion of all measures in the soccer athlete sample and the student sample.*

Variables	Athlete Sample						Student Sample					
	1	2	3	4	5	6	1	2	3	4	5	6
1. PIB	-	.44**	.57**	.31**	.73**	.01	-	.39**	.69**	.18*	.70**	.03
2. LFT		-	.40**	.34**	.72**	.10		-	.39**	.28**	.66**	.05
3. AWF			-	.37**	.79**	.06			-	.44**	.83**	-.01
4. DEP				-	.70**	-.10				-	.75**	-.01
5. COMP					-	.06					-	.03
6. Social desirability						-						-

*Note. \*p<.05, \*\*p<.01*