

## Measuring decentering as a unidimensional construct

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4 **Measuring Decentering as a Unidimensional Construct: The Development and Initial**  
5 **Validation of the Decentering Scale for Sport**

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**Abstract**

Decentering, the ability to observe one’s thoughts and feelings from a detached view, has gained increased attention in recent years. With this renewed interest comes a need for a reliable and valid tool to measure decentering in sport contexts. Therefore, in this multi-study paper we report the development and initial validation of a sport-specific self-report measure of decentering, the Decentering Scale for Sport (DSS). Based on an initial pool of context-specific items with acceptable content validity, a unidimensional decentering construct was confirmed in four independent athletic samples ( $n = 1255$ ). Satisfactory internal consistency reliability and partial measurement invariance across gender and sport type was demonstrated. Convergent and concurrent validity of the DSS was established by showing positive and medium to large associations with mindfulness, well-being, flow, vitality, enjoyment and positive affect, and negative and medium to large associations with cognitive fusion, experiential avoidance, anxiety and negative affect. Discriminant validity of decentering with mindfulness and self-compassion was also established. Findings suggest that the DSS is a reliable and valid measure of decentering in sport contexts, and can be applied in future research and applied practice to measure decentering.

*Keywords:* Athlete; cognitive defusion; decentering; factor analysis; re-perceiving; scale development

46 Measuring Decentering as a Unidimensional Construct: The Development and Initial Validation  
47 of the Decentering Scale for Sport

48 The ability to observe thoughts, feelings and bodily sensations as transient mental events  
49 rather than self-related truths or facts in decentering (Safran & Segal, 1990) can help athletes  
50 deal with perceived pressure, performance anxiety and even avoid choking. If athletes are able to  
51 take on a detached view of their thoughts and feelings, they can avoid poor performance by  
52 viewing stressful situations as challenges or simply psychological events rather than threats  
53 (Jones, Meijen, McCarthy, & Sheffield, 2009). For example, confronted with pre-competition  
54 anxiety, an athlete engaged in a decentered state might say “I think that I feel nervous right now”  
55 instead of “I am nervous”, which can alleviate the maladaptive influences of the interpretation of  
56 anxiety. On the other hand, when faced with a verbally aggressive coach, athletes who adopt a  
57 decentering approach might choose to respond based on the interaction itself rather than their  
58 perceived norm (e.g., negative experiences) of the coach (Gardner & Moore, 2007). In short,  
59 decentering enables athletes to distinguish “what the mind is and what the mind tells us it is”  
60 (Gardner & Moore, 2007, p. 91).

61 Traditionally, decentering has been described as a central change process in cognitive  
62 therapies that help clients to experientially realize the role their own minds play in constructing  
63 their reality, namely, “stepping outside one’s immediate experience and observing oneself in the  
64 process of constructing that experience” (Safran & Segal, 1990, p. 117). Initial efforts to measure  
65 decentering can be traced back to the measurement of the related construct of metacognitive  
66 awareness from the Measure of Awareness and Coping in Autobiographical Memory (MACAM;  
67 Moore, Hayhurst, & Teasdale, 1996). However, the MACAM is time consuming and unpractical  
68 given that it requires people listen to taped vignettes and also complete a semi-structured

69 interview (Fresco, Moore, et al., 2007). The psychometric assessment of decentering originated  
70 with the development of the Experiences Questionnaire (EQ; Fresco, Moore, et al., 2007), which  
71 originally consisted of fourteen items to measure the factor of decentering and another six  
72 rumination items designed to control for response bias. The items of the decentering factor were  
73 developed to capture people's ability to distinguish their thoughts from a sense of one's self and  
74 to engage with negative experiences without reacting to them, as well as the capacity to extend  
75 compassion to one's self. Subsequent analyses did not support the two-factor model, and an 11-  
76 item unidimensional EQ was confirmed after removing the rumination factor. The  
77 unidimensional construct of decentering has gained support in a Spanish sample of people with  
78 and without psychiatric disorders (Soler et al., 2014) and also in a sample of Portuguese people  
79 with a wide age range from 14 to 66 years old (Gregório, Pinto-Gouveia, Duarte, & Simões,  
80 2015). However, there is evidence to suggest that the unidimensional structure does not always  
81 generalize. For example, two dimensions of accepting self-perception and distanced perspective  
82 were revealed in a sample of German university students (Gecht, Kessel, Mainz et al., 2014),  
83 whereas subscales relating to cognitive defusion and self-as-context were identified in a sample  
84 of people with chronic pain (McCracken, Barker, & Chilcot, 2014). Therefore, the question  
85 remains as to whether decentering is a multidimensional or a unidimensional construct.

86         Recently, scholars have critiqued the conceptualization of decentering in the EQ in that it  
87 is unclear why and how items of the self-compassion facet relate to the core construct of  
88 decentering (Forman et al., 2012; Gillanders et al., 2014). This criticism appears warranted,  
89 given that self-compassion is viewed as an independent construct that includes three  
90 components: self-kindness (treating oneself kindly), common humanity (linking with others in  
91 extenso), and mindfulness (living with one's thoughts and feelings non-reactively) (Neff, 2003a).

92 Although it seems that self-compassion represents a positive view of one's self, the inclusion of  
93 this multidimensional concept as part of what is proposed to be a unidimensional construct of  
94 decentering muddies the conceptual boundaries. Relatedly, there are several concepts similar to  
95 decentering that do not include the facet of self-compassion, such as re-perceiving (disidentify  
96 from the contents of consciousness and view one's moment-by-moment experience with greater  
97 clarity and objectivity; Shapiro, Carlson, Astin, & Freedman, 2006, p. 377) and cognitive  
98 defusion (distancing from thoughts, literally experiencing thoughts as mental events that do not  
99 necessarily need to be acted on; Hayes, Strosahl, & Wilson, 2011). Although decentering  
100 originated from the traditional cognitive therapies, re-perceiving is a similar concept widely  
101 recognized along with the mindfulness-based therapies (Shapiro et al., 2006), and cognitive  
102 defusion is another similar concept that is grounded on the acceptance-based therapy (i.e.,  
103 acceptance and commitment therapy; Hayes et al., 2011); sometimes these concepts have been  
104 used interchangeably (Hayes-Skelton, Calloway, Roemer, & Orsillo, 2015).

105         Decentering is a key construct that is related to individuals' adaptive and maladaptive  
106 psychological constructs (Bernstein et al., 2015). In previous decentering scale development  
107 studies, initial evidence has shown that decentering is positively associated with mindfulness,  
108 cognitive reappraisal, positive affect, and satisfaction with life, and negatively related to  
109 experiential avoidance, rumination, negative affect, depression, anxiety, stress, expressive  
110 suppression, brooding, and cognitive fusion (e.g., Fresco, Moore, et al., 2007; Gregório et al.,  
111 2015). Experimental evidence has supported the protective role of decentering in that, even with  
112 high levels of rumination, individuals high in decentering produced better task performance  
113 when exposed to interpersonal criticism (Kaiser, Andrews-Hanna, Metcalf, & Dimidjian, 2015).  
114 Moreover, mediation analyses have supported decentering as a mediator of the effect from

115 mindfulness and cognitive reappraisal to anxiety symptoms (Hayes-Skelton & Graham, 2013;  
116 Pearson, Brown, Bravo, & Witkiewitz, 2015), mindfulness to depressive symptoms (Gecht,  
117 Kessel, Forkmann et al., 2014; Pearson et al., 2015), self-focus to negative thinking in depression  
118 (Lo, Ho, Nicky, & Siu, 2014), and rumination to depression (Gregório et al., 2015).

119         In applied settings, decentering represents an immediate and approximate process in the  
120 changing mechanism of various psychotherapies and psychological training, including cognitive  
121 behavioral therapy (Fresco, Segal, Buis, & Kennedy, 2007), relaxation interventions (Hayes-  
122 Skelton, Usmani, Lee, Roemer, & Orsillo, 2012) and mindfulness training (Orzech, Shapiro,  
123 Brown, & McKay, 2009). To cultivate a decentered perspective on thoughts, sensations, and  
124 emotions, clients might be repeatedly required to observe and identify their thoughts through  
125 writing them down (Safran & Segal, 1990) or formal mindfulness meditation (Segal, Williams,  
126 & Teasdale, 2002). Initial evidence has supported decentering as an ability that precedes anxiety  
127 disorders across both applied relaxation and acceptance-based behavioral therapy treatments  
128 (Hayes-Skelton et al., 2015). Moreover, decentering has also been proposed as one of the  
129 mechanisms of change in mindfulness interventions (Sauer & Baer, 2010). Neuroimaging  
130 research has corroborated the mediating role of decentering, in which non-meditators who  
131 practiced mindful attention could produce decentering to help them reduce the perceived stress  
132 through disengaging their embodied self from the imagined stressful situation (Lebois et al.,  
133 2015).

134         In sport, one important aim of mindfulness training is to cultivate athletes' ability to  
135 decenter from previously formed automatic connections among thoughts, feelings, and  
136 behavioral choices (Gardner & Moore, 2004). In mindfulness training, athletes are encouraged to  
137 view their thoughts as simply passing events that may or may not accurately reflect the realities

138 around them, and the decentering ability is produced accordingly (Gardner & Moore, 2007).  
139 Adaptive psychological experiences such as flow and aspects of self-confidence are enhanced  
140 along with the increase of decentering (Kaufman, Glass, & Arnkoff, 2009). On the other hand,  
141 maladaptive psychological experiences will be low in individuals with high levels of  
142 decentering, in particular perceptions of stress (Lebois et al., 2015) and stress-related symptoms  
143 (e.g., burnout). Decentering skills can also help injured athletes to take an objective view of  
144 frustration, boredom or anxiety during their rehabilitation (Mahoney & Hanrahan, 2011).  
145 Further, investigating the mediating role of decentering in sport would allow for the development  
146 of more systematic evidence-based interventions through addressing an important gap in the  
147 existing evidence of a changing mechanism of mindfulness training in sport contexts. The  
148 identification of mediational pathways (e.g., decentering) will allow researchers to systematically  
149 tailor interventions to increase the effectiveness of mindfulness training. Recently, sport-specific  
150 mindfulness questionnaires have been developed for athletic populations, such as the  
151 Mindfulness Inventory for Sport (MIS; Thienot et al., 2014) and the Athletes Mindfulness  
152 Questionnaire (AMQ; Zhang, Chung, & Si, in press). Yet, the systematic investigation of the  
153 mediating role of decentering in mindfulness-based interventions in sport cannot be established  
154 without a psychometrically sound tool to assess this concept.

155         More research is needed to clarify and synthesize decentering by testing it in different  
156 contexts and using different populations. In the current study, we aimed to examine the  
157 conceptualization of decentering in sport contexts. Specifically, the purpose of the current study  
158 was to develop a psychometrically sound self-report questionnaire that captures decentering in a  
159 sport context, entitled the Decentering Scale for Sport (DSS), using four samples of Chinese  
160 athletes. In so doing, we sought to further examine whether decentering is best conceptualized as



161 a unidimensional (Fresco, Moore, et al., 2007; Soler et al., 2014) or multidimensional construct  
162 (Gecht, Kessel, Mainz et al., 2014; McCracken et al., 2014). Efforts have also been made to  
163 ensure that decentering is not conceptualized in the same way as mindfulness, because they have  
164 been demonstrated to represent two independent constructs (Gecht, Kessel, Forkmann et al.,  
165 2014). It should be noted that mindfulness emphasizes sustained self-regulation of attention,  
166 awareness and attitude of accepting thoughts, feelings, and sensations (Fresco, Moore, et al.,  
167 2007), whereas decentering focuses on the cognitive distance from what our mind tells us and  
168 what the truth is.

169 A multi-study approach was adopted in this research program. In Study 1, an initial pool  
170 of decentering items was generated based on the conceptualization of decentering in two facets  
171 (Fresco, Moore, et al., 2007), excluding the facet of self-compassion. Items were generated from  
172 semi-structured interviews with coaches and athletes. In Study 2, exploratory factor analysis  
173 (EFA) was conducted in a sample of Chinese athletes ( $n = 271$ ), in order to explore the  
174 dimensionality of the item pool and to provide initial information on the model fit indices of the  
175 measurement model. In Study 3, confirmatory factor analysis (CFA) was conducted to confirm  
176 the factor structure of the DSS, explore convergent and concurrent validities, and test its  
177 invariance across gender and sport type. A package of self-report measures of mindfulness,  
178 experiential avoidance, well-being and dispositional flow, along with the DSS was completed by  
179 another independent sample of Chinese athletes ( $n = 357$ ). In Study 4, the factor structure of the  
180 DSS, confirmed in Study 3, was cross-validated, and its concurrent validity was further  
181 examined in a third independent sample of Chinese athletes ( $n = 295$ ) by asking them to provide  
182 self-report assessments of athlete burnout, anxiety, enjoyment, positive and negative affect, and  
183 vitality. In Study 5, the DSS confirmed in Studies 3 and 4, was further tested in a fourth sample

184 of Chinese athletes ( $n = 332$ ) along with self-report measures of mindfulness, self-compassion,  
185 cognitive fusion, and rumination, with the aim to examine the discriminant (with mindfulness  
186 and self-compassion) and concurrent validities of the DSS.

### 187 **Study 1 – Item Generation and Content Validity**

188 Study 1 aimed to develop and provide evidence for the content validity of a pool of items  
189 that were designed to tap athletes' decentering in sport context, using athletes, coaches, and  
190 experts' qualitative and quantitative feedback.

#### 191 **Method**

192 **Participants.** In total, 27 Chinese athletes (16 males and 11 females) and 8 Chinese  
193 coaches (6 males and 2 females) from five competitive sports (diving, gymnastics, synchronized  
194 swimming, table tennis, and wushu) participated in this study. The coaches' experience ranged  
195 from 1 to 25 years ( $M = 10.13$ ;  $SD = 9.28$ ). The athletes were aged between 18 and 27 years ( $M$   
196  $= 20.93$ ;  $SD = 2.29$ ) and their competitive experience (15 at national level and 12 at international  
197 level) ranged from 7 to 23 years ( $M = 13.37$ ;  $SD = 4.34$ ). A panel of seven Chinese mindfulness  
198 and CBT experts were also consulted to review the content validity of the items.

199 **Procedure.** The items, referring to decentering in a sport context, were developed over  
200 several stages. At the first stage, the EQ (Fresco, Moore, et al., 2007) and relevant decentering  
201 literature were used as a reference in the development of the sport-specific items. At the second  
202 stage, we performed five semi-structured interviews with coaches (30-60 mins), one focus group  
203 with three wushu coaches (52 mins), and five focus groups (90-110 mins) with athletes. At the  
204 third stage, athletes who participated in stage two assessed the relevance of each item in the  
205 context of sport using a dichotomous scale (1 = *applicable*, 0 = *inapplicable*). Items that were  
206 deemed inapplicable by one third (33%) or more of the athletes were eliminated. Applicable

207 items that were rated below 5 were considered problematic (1 = *not at all clear* to 7 = *extremely*  
208 *clear*); athletes were encouraged to suggest alternative wordings for these problematic items. At  
209 the final stage, a reduced pool of items was sent via email to seven national experts. Two steps  
210 were taken in this stage. Firstly, the experts were asked to rate the representativeness of each  
211 item with regard to the concept of decentering, using a 4-point response scale from 1 (*not*  
212 *relevant*) to 4 (*highly relevant*). Secondly, four of the seven experts were again asked to rate the  
213 representation of the revised items using the same 4-point response scale (see Polit, Beck, &  
214 Owen, 2007).

215 **Data analysis.** The item-level content validity index (I-CVI; Lynn, 1986; Polit et al.,  
216 2007) was calculated for each item by dividing the number of experts who rated the item as a  
217 quite relevant or highly relevant (rating 3 and 4) by the total number of experts who provided  
218 ratings. When an expert panel consists of six or more reviewers, I-CVIs over the .78 criteria are  
219 considered to be excellent (Lynn, 1986). The scale-level content validity index (S-CVI/Ave) was  
220 calculated by averaging all the I-CVIs; an S-CVI/Ave over .90 is considered to be satisfactory  
221 (Polit et al., 2007).

## 222 **Results and Discussion**

223 Initially, 28 items were generated and another 21 items were suggested by coaches and  
224 athletes, which formed a pool of 49 items. Based on the athletes' evaluations, 21 items were  
225 deemed inapplicable in the sport context and were thus eliminated (e.g., "During training and  
226 competition, I view the emerged experiences from a wider perspective"), whereas 14 items were  
227 modified to improve their clarity and broaden their applicability across sports (e.g., "During  
228 training and competition, I notice that all kinds of thoughts and feelings are temporary, not  
229 *necessarily* the truth"). Of the remaining 28 items, five items that displayed a CVI of .71 (5/7) or

230 below were deleted. Minor modifications were made to the wording of six items and one new  
231 item was added. This process resulted in a pool of 24 items, with a satisfactory S-CVI/Ave  
232 of .98.

### 233 **Study 2 – Examination of the Factor Structure of DSS**

234 In Study 2, we examined the factorial composition of the pool of 24 items generated in  
235 Study 1 using exploratory factor analysis (EFA) in order to avoid the misspecification of number  
236 of factors in the decentering construct.

#### 237 **Method**

238 **Participants.** A total of 271 athletes (136 females and 135 males;  $M_{\text{age}} = 21.55$  years,  
239  $SD_{\text{age}} = 3.15$ ; range 18 - 33) participated in Study 2. All participants were recruited from two  
240 elite sport training centers in China, and drawn from 18 different sports, comprising a variety of  
241 individual ( $n = 209$ ; e.g., archery, athletics, and weightlifting) and team ( $n = 62$ ; e.g., basketball,  
242 handball, and water polo) disciplines. The majority of participants were competing at national  
243 levels ( $n = 176$ ), with some athletes competing or had competed at the international level ( $n =$   
244  $95$ ). On average, athletes had participated in their sport competitively for 9.03 years ( $SD = 4.29$ ;  
245 range 1 - 22).

246 **Measure and procedures.** The items generated in Study 1 were converted into  
247 questionnaire format, and a 5-point scale ranging from 1 (*never true*), 2 (*rarely true*), 3  
248 (*sometimes true*), 4 (*often true*), to 5 (*always true*) was assigned. Coaches and team managers  
249 were contacted directly; the purpose and nature of the study was explained and permission  
250 requested to approach the athletes. Upon receiving verbal approval, the researchers distributed  
251 the questionnaire to athletes in person and informed consent was received. Athletes either

252 completed the survey at the training venue prior to, or after the training session, or chose to take  
253 the survey home with them, and returned it at the next training session.

254 **Data analysis.** The 24 items were analyzed using exploratory factor analysis (EFA)  
255 within Mplus 7 (Muthén & Muthén, 1998-2012) to identify the underlying dimension(s) of  
256 decentering. Due to the documented shortcomings associated with maximum likelihood (ML) for  
257 the estimation of models with ordinal data (Schmitt, 2011), a polychoric correlation matrix using  
258 weighted least squares mean- and variance- adjusted (WLSMV) estimation procedure with an  
259 oblique Geomin rotation was carried out. The percentage of missing data was negligible (0.15%)  
260 and was treated using pairwise deletion to produce unbiased estimates for the parameters and  
261 their standard errors. Geomin rotation was selected in order to minimize cross-loadings while  
262 producing statistically significant factor loadings on the primary factors, which is likely to  
263 generate cleaner factor structures that are similar to CFA (Schmitt & Sass, 2011).

264 Following the recommendation of Schmitt (2011), the number of factors was determined  
265 with parallel analysis (PA) in Mplus 7, and then evaluated using model-data fit indices. Multiple  
266 fit indices including the comparative fit index (CFI), the Tucker-Lewis index (TLI), and the root  
267 mean square error of approximation (RMSEA) were used to assess support for the initial EFA  
268 model we obtained (Norberg, Wetterneck, Sass, & Kanter, 2011). According to existing  
269 interpretation guidelines for adequate and/or acceptable model-data fit (e.g., Hu & Bentler, 1998,  
270 1999; MacCallum et al, 1996; Marsh, Hau, & Grayson, 2005; Marsh, Hau, & Wen, 2004), a  
271 value of CFI and TLI greater than .90 is considered as adequate model fit, greater than .95 and  
272 above has been suggested to indicate an excellent fit; a value of RMSEA less than or equal to .06  
273 indicates a good fit, whereas less than or equal to .08 shows an adequate fit with the upper bound  
274 of the 90% RMSEA confidence interval  $\leq .10$ ; the value for SRMR ranges from zero (perfect

275 model) to one, with a value below .08 deemed as acceptable. Nevertheless, it is important to  
276 acknowledge that these values represent *guidelines* rather than ‘golden rule’s (i.e., yes/no  
277 decision).

278 In terms of interpreting the extracted factors, items were removed in the following order:  
279 (1) items with high cross-loadings (i.e.,  $> .30$ ), and (2) items with primary factor loadings  $\leq .40$ ,  
280 indicating that items did not load on any factor. Items were removed independently based on the  
281 item severity following a sequence of factor analyses until an approximate simple structure was  
282 obtained. A minimum internal reliability of the factor using composite reliability (rho [ $\rho$ ];  
283 Raykov, 1997) was set as .70.

## 284 **Results and Discussion**

285 The initial EFA with 24 items revealed that a three-factor solution existed based on the  
286 parallel analysis (mean eigenvalue), but a number of items had either small primary factor  
287 loadings ( $\lambda < .40$ ) or large cross-loadings ( $\lambda > .30$ ). Based on our a priori criteria, eight items  
288 were removed in a series of factor analyses. Subsequently, a two-factor solution was supported  
289 based on the parallel analysis. The eigenvalues were 4.37 and 1.74 for Factors 1 and 2, which  
290 explained 27.31 and 10.88 percentage of variance, respectively. However, only two reverse-  
291 worded items (i.e., Item 15 and 16) had large primary factor loadings ( $\lambda > .40$ ) on Factor 2, and  
292 item 21 had small primary factor loading ( $\lambda < .40$ ) but large cross-loading ( $\lambda > .30$ ) (see Table 1).  
293 In addition, the inter-factor correlation was very low in magnitude ( $r = .09$ ). An inspection of the  
294 substantive content of these items revealed that all of them used the phrase of “thoughts and  
295 ideas”, in which the factor appeared to be caused by a method factor (i.e., the similar description  
296 of items) rather than the existence of a true common theme. Therefore, the decision was made to  
297 remove Factor 2 through removing Items 21, 15, and 16. Another EFA was then conducted and a

298 unidimensional factor solution was supported by the parallel analysis, with acceptable model fit  
299 statistics,  $\chi^2(65) = 144.57, p < .001, CFI = .95, TLI = .94, SRMR = .055, RMSEA(90\% CI)$   
300  $= .067(.052, .082)$ . An overview of the item factor loadings is detailed in Table 1. The  
301 unidimensional factor was internally reliable ( $\rho = .85$ ).

### 302 **Study 3 – Validation of the Factor Structure and Concurrent and Convergent Validities**

#### 303 **Evidence of the DSS**

304 The purpose of Study 3 was to cross-validate the unidimensional model of decentering  
305 identified in the EFA findings of Study 2 using an independent sample. We also examined the  
306 invariance of DSS scores across sport type (individual and team sports) and gender. Furthermore,  
307 the concurrent and convergent validities of the DSS were examined with measures of  
308 mindfulness, flow, well-being, and experiential avoidance. In line with previous studies of  
309 decentering (Fresco, Moore, et al., 2007; Gregório et al., 2015), it was hypothesized that  
310 decentering would be positively associated with mindfulness, flow, well-being, and negatively  
311 associated with experiential avoidance.

#### 312 **Method**

313 **Participants.** A total of 357 athletes (148 females, 208 males, and one unknown;  $M_{age} =$   
314  $21.28$  years,  $SD_{age} = 3.94$ ; range 17 - 45) participated in Study 3. All participants were recruited  
315 from six elite sport training centers in China, and drawn from 27 different sports, comprising a  
316 variety of individual ( $n = 254$ ; e.g., cycling, judo, and shooting) and team ( $n = 103$ ; e.g.,  
317 handball, rugby, and soccer) disciplines. The majority of participants were competing at national  
318 levels ( $n = 238$ ), with some athletes competing or had competed at the international level ( $n =$   
319  $119$ ). On average, athletes had participated in their sport competitively for 6.91 years ( $SD = 4.13$ ;  
320 range 1 - 27).

321 **Measures.**

322 ***Decentering scale for sport.*** The 13-item Decentering Scale for Sport (DSS) developed  
323 in Study 2.

324 ***Mindful attention awareness scale*** (MAAS; Brown & Ryan, 2003). The MAAS is a  
325 unidimensional scale measuring the presence or absence of attention to and awareness of  
326 present-moment experiences, with 15 items (e.g., “I rush through activities without being really  
327 attentive to them”) rated on a 6-point scale from 1 (*almost always*) to 6 (*almost never*). The  
328 Chinese version of the MAAS has demonstrated satisfactory construct validity, and good internal  
329 consistency reliability ( $\rho = .86$ ) and test-retest reliability ( $r = .66$ ) in a sample of elite Chinese  
330 athletes (Chung, Si, Liu, & Zhang, 2013).

331 ***Acceptance and action questionnaire II*** (AAQ-II; Bond et al., 2011). The AAQ-II is a 7-  
332 item self-report measure used to assess the tendency to avoid aversive internal experiences (e.g.,  
333 negative emotions, thoughts, and memories). Items (e.g., “I’m afraid of my feelings”) are rated  
334 on a 7-point scale, from 1 (*never true*) to 7 (*always true*). The Chinese version of the AAQ-II has  
335 demonstrated satisfactory construct validity, and good internal consistency reliability ( $\rho = .85$ )  
336 and test-retest reliability ( $r = .74$ ) in a sample of elite Chinese athletes (Zhang, Chung, Si, & Liu,  
337 2014).

338 ***Short dispositional flow scale*** (SDFS; Jackson, Martin, & Eklund, 2008). The SDFS is a  
339 9-item scale rated on a 5-point scale, ranging from 1 (*never*) to 5 (*always*) assessing the  
340 frequency with which people experience flow in a target activity, that is, fully immersed in what  
341 one does (e.g., “During training and competition, I know clearly what I want to do”). The  
342 Chinese version of the SDFS has demonstrated satisfactory construct validity, and good internal



343 consistency reliability ( $\alpha = .73$ ) and test-retest reliability ( $r = .70$ ) in a sample of Chinese college  
344 athletes (Liu, 2010).

345         ***Training and competition well-being scale*** (TCWS; Zhang & Liang, 2002). The TCWS  
346 is a 6-item scale developed to assess Chinese athletes' subjective well-being during training and  
347 competition. Items (e.g., "I am satisfied with my training and competition") are scored on 7-point  
348 scale (1 = *strongly disagree* to 7 = *strongly agree*). The TCWS has demonstrated satisfactory  
349 construct validity and good internal consistency reliability ( $\alpha = .73$ ) in a sample of elite Chinese  
350 athletes (Zhang & Liang, 2002).

351         **Procedures.** The data collection procedure was the same as outlined in Study 2.

352         **Data analysis.**

353         ***Factorial validity.*** To cross-validate the findings of the EFA, the 13 items were analyzed  
354 via CFA within Mplus 7 (Muthén & Muthén, 1998-2012) using the polychoric correlation matrix  
355 and the WLSMV estimator. The adequacy of the model was evaluated using model-data fit  
356 statistics (multiple fit indices) and estimated standardized factor-loadings. The fit statistics (i.e.,  
357  $\chi^2$ , CFI, TLI, and RMSEA) outlined in Study 2 and the weighted root mean square residual  
358 (WRMR) were employed to evaluate model fit for the CFA. Values of WRMR close to or less  
359 than 1.0 have been suggested as indicative of adequate model fit (Yu, 2002). There was a  
360 negligible percentage of missing data (0.15%); however, all missing data were treated use  
361 pairwise deletion. Modification indices, standardized factor loadings, and standardized residuals  
362 were also examined. Items with factor loadings below .40 and large absolute values of  
363 standardized residuals ( $> 2.00$ ) were considered for removal.

364         ***Concurrent and convergent validities.*** Descriptive statistics and internal consistency  
365 reliabilities of the DSS using composite reliability were calculated. Concurrent and convergent

366 validities were examined using latent factor correlations between the DSS, MAAS, AAQ-II,  
367 TCWS, and SDFS in Mplus 7. Although the traditional interpretation concerning the effect size  
368 of correlation coefficients follows the guidelines provided by Cohen (1988) as small ( $r = 0.1$ ),  
369 medium ( $r = 0.3$ ), or large ( $r = 0.5$ ), recent research suggests that they are not representative of  
370 the findings in applied psychology (Bosco, Aguinis, Singh, Field, & Pierce, 2015). Based on an  
371 analysis of 147,328 correlational effect sizes published in the *Journal of Applied Psychology* and  
372 *Personnel Psychology* from 1980 to 2010, Bosco and colleagues proposed a revised set of  
373 empirical benchmarks (small,  $r = 0.09$ ; medium,  $r = 0.16$ ; large,  $r = 0.26$ ). We employed these  
374 contemporary benchmarks to guide our interpretations in the current study.

375 **Measurement invariance.** To examine whether the DSS displayed invariance across  
376 gender and sport type (team and individual), a sequential model testing approach was employed  
377 via multisample CFA using the weighted least squares mean and variance (WLSMV) estimation  
378 on a polychoric matrix in Mplus 7. The invariance testing for ordinal data consists of two steps  
379 (e.g., Carrola, Yu, Sass, & Lee, 2012). The first step is to test configural invariance, that is,  
380 whether the same items are indicators of the same factor across groups. The second step is to test  
381 measurement invariance whereby factor loadings and thresholds are constrained to be equal  
382 across groups. Given that the data were ordinal Likert-type, item thresholds were modeled  
383 instead of intercepts or means. The factor loadings and thresholds were constrained in tandem  
384 because the item characteristic curve is influenced by both parameters (Millsap & Yun-Tein,  
385 2004). To assess the degree of invariance, differences in chi-square values ( $\Delta \chi^2$ ) were examined  
386 using the DIFFTEST procedure in Mplus 7. Statistical significance of the  $\Delta \chi^2$  after a Bonferroni  
387 adjustment was considered given that the WLSMV estimator does not allow for a direct

388 comparison between a less restrictive and more restrictive models using  $\Delta$ CFI,  $\Delta$ RMSEA, and  
389  $\Delta$ TLI (Sass, 2011).

## 390 **Results and Discussion**

391 **Confirmatory factor analysis.** Results of CFA on the 13-item measurement model  
392 suggested an acceptable fit to the data, but indicated room for improvement:  $\chi^2 (56) = 211.95, p$   
393  $< .001$ , CFI = .94, TLI = .93, WRMR = 1.10, RMSEA (90% CI) = .08 (.068, .092). One item  
394 (Item 23) exhibited low standardized factor loadings ( $\lambda = .359$ ). Inspection of the substantive  
395 content of this item revealed that it overlapped with that of another item (Item 7) in the list,  
396 suggesting that it should be removed to improve model simplicity. Excluding Item 23 improved  
397 the fit of the model to the data:  $\chi^2 (54) = 156.97, p < .001$ , CFI = .96, TLI = .95, WRMR = .97,  
398 RMSEA (90% CI) = .07 (.060, .087). The 12-item DSS demonstrated good internal consistency  
399 ( $\rho = .88$ ). The item means, standard deviations, standardized factor loadings and residuals are  
400 displayed in Table 1. Findings on the CFA of the measurement models of the criterion-related  
401 measures are listed at Table 3.

402 **Invariance testing.** The goodness-of-fit indices for all multi-group models of gender  
403 invariance and sport type invariance are displayed in Table 2. Male athletes in our samples did  
404 not use the response option “(1) never true”, leaving item 20 for male athletes with only three  
405 thresholds (2-3, 3-4, 4-5). Therefore, item 20 was not included in further invariance tests for  
406 gender. With regard to gender, factor loadings and thresholds of Items 5 and 19 between male  
407 and female athletes exhibited the largest modification indices and were thus relaxed sequentially  
408 to improve model fit, which resulted in an invariant measurement model. With regard to sport  
409 type, the factor loading and threshold of Item 4 between individual and team athletes exhibited  
410 the largest modification index and was therefore relaxed to improve model fit, which also

411 resulted in an invariant measurement model. Taken together, these analyses provided initial  
412 support for the partial measurement invariance of the DSS model across gender and sport type.

413 **Concurrent and convergent validities.** With regard to convergent validity, the DSS  
414 showed a significant and positive large correlation with mindfulness as measured by MAAS ( $r$   
415 = .27,  $p < .001$ ). With regard to concurrent validity, the DSS also showed a significant and  
416 positive large correlation with flow ( $r = .54$ ,  $p < .001$ ) and subjective well-being ( $r = .40$ ,  $p$   
417  $< .001$ ). In addition, the DSS indicated a significant and negative large correlation with  
418 experiential avoidance ( $r = -.30$ ,  $p < .001$ ) (see Table 3).

#### 419 **Study 4 – Cross-Validation of the Factor Structure of the DSS and Additional Concurrent** 420 **Validity Evidence**

421 Using another independent sample of athletes, the purpose of Study 4 was to cross-  
422 validate the unidimensional model of decentering supported in Study 3 via CFA. The concurrent  
423 validity of the DSS was further examined via associations with measures of anxiety, burnout,  
424 vitality, enjoyment, and positive and negative affect. In line with previous studies of decentering  
425 (Fresco, Moore, et al., 2007; Gregório et al., 2015), it was hypothesized that decentering would  
426 be positively associated with vitality, enjoyment, and positive affect, and negatively associated  
427 with anxiety, burnout, and negative affect.

#### 428 **Method**

429 **Participants.** A total of 295 athletes (137 females and 158 males;  $M_{\text{age}} = 21.34$  years,  
430  $SD_{\text{age}} = 3.19$ ; range 17 - 37) participated in Study 4. All participants were recruited from four  
431 elite sport training centers in China, and drawn from 20 different sports, comprising a variety of  
432 individual ( $n = 193$ ; e.g., athletics, swimming and wrestling) and team ( $n = 102$ ; e.g., baseball,  
433 volleyball, and water polo) disciplines. The majority of participants were competing at national

434 levels ( $n = 195$ ), with some athletes competing or had competed at the international level ( $n =$   
435 97). On average, athletes had participated in their sport competitively for 7.33 years ( $SD = 3.83$ ;  
436 range 1 - 23).

437 **Measures.**

438 ***Decentering scale for sport.*** The 12-item DSS developed in Study 3.

439 ***Athlete burnout questionnaire*** (ABQ; Raedeke & Smith, 2001). The ABQ is a 15-item  
440 self-report instrument representing three burnout subscales: emotional/physical exhaustion (5  
441 items; e.g., “I am exhausted by the mental and physical demands of sport”), reduced sense of  
442 accomplishment (5 items; e.g., “I am not achieving much in sport”), and sport devaluation (5  
443 items; e.g., “The effort I spent in sport would be better spent doing other things”). All items were  
444 rated on a 5-point scale ranging from 1 (*almost never*) to 5 (*almost always*).

445 ***Subjective vitality scale*** (SVS; Bostic, Rubio, & Hood, 2000). The SVS is a 6-item scale  
446 that measures athletes’ levels of subjective vitality in sport, a positive feeling of aliveness and  
447 energy (e.g., “I feel alive and vital”). Responses were provided on a 7-point scale ranging from 1  
448 (*not at all true*) to 7 (*very true*).

449 ***International positive and negative affect schedule short form*** (IPANAS-SF;  
450 Thompson, 2007). The IPANAS-SF is a 10-item scale that measures athletes’ positive (5 items;  
451 e.g., “Active”) and negative affect (5 items; e.g., “Upset”). Respondents were requested to rate  
452 the statement on a 5-point scale ranging from 1 (*never*) to 5 (*always*).

453 ***Sport enjoyment scale*** (SES; Scanlan, Carpenter, Schmidt, Simons, & Keeler, 1993). The  
454 4-item SES was used to measure athletes’ positive affective response to their sport experience  
455 that reflects generalized feelings such as pleasure, liking, and fun (e.g., “Do you enjoy playing

456 your sport”). Responses were provided on a 5-point Likert scale ranging from 1 (*not at all*) to 5  
457 (*very much*).

458 **Sport competition anxiety test** (SCAT; Martens, Vealey, & Burton, 1990). The SCAT is  
459 a 15-item self-report instrument measuring symptoms associated with anxiety that utilized a 3-  
460 point scale (1 = *hardly ever*, 2 = *sometimes*, 3 = *often*) (e.g., “Before I compete I feel uneasy”).

461 **Procedures.** Prior to data collection, the abovementioned questionnaires were translated  
462 into Chinese using forward- and back-translation procedures (Hambleton, 2005). The data  
463 collection procedure was the same as those outlined in Studies 2 and 3.

#### 464 **Data Analysis**

465 Data analysis methods included two aspects: (a) testing the factorial validities of the 12-  
466 item unidimensional DSS and the translated criterion-related measures via CFA within Mplus 7  
467 (Muthén & Muthén, 1998-2012), and (b) examining the concurrent validity of the DSS via latent  
468 factor correlations between the DSS and the criterion-related measures. The percentage of  
469 missing data was negligible (0.20%) and were treated using pairwise deletion.

#### 470 **Results and Discussion**

471 **Confirmatory factor analysis.** CFA of the 12-item unidimensional DSS displayed an  
472 acceptable fit to the data:  $\chi^2(54) = 136.78, p < .001, CFI = .94, TLI = .93, WRMR = .95,$   
473  $RMSEA(90\% CI) = .072 (.057, .087)$ . The DSS demonstrated good internal consistency ( $\rho$   
474 = .83). The item means, standard deviations, standardized factor loadings and residuals are  
475 displayed in Table 1. Findings on the CFA of the measurement models of the criterion-related  
476 measures are listed at Table 4.

477 **Concurrent validity.** There were significant and medium to large positive associations  
478 between decentering as measured by the DSS and vitality as measured by the SVS ( $r = .25, p$

479 < .001), positive affect as measured by the IPANAS-SF-PA ( $r = .20, p < .001$ ), and enjoyment as  
480 measured by the SES ( $r = .18, p < .01$ ). There were significant and medium to large negative  
481 correlations between decentering as measured by the DSS and negative affect as measured by the  
482 IPANAS-SF-NA ( $r = -.17, p < .01$ ), anxiety as measured by the SCAT ( $r = -.19, p < .01$ ), and  
483 reduced sense of accomplishment as measured by the ABQ ( $r = -.21, p < .01$ ), but not the ABQ  
484 subscales of emotional/physical exhaustion and devaluation which were non-significant (see  
485 Table 4).

### 486 **Study 5 – Cross-Validation of the Factor Structure of the DSS and Further Examination of** 487 **the Concurrent and Discriminant Validities of the DSS**

488 The purposes of Study 5 were to test the discriminant validity of the DSS with measures  
489 of mindfulness and self-compassion, as well as the concurrent validity with measures of  
490 cognitive fusion and rumination using another sample of athletes. With regard to the discriminant  
491 validity, the 95% confidence interval of the latent factor correlations (i.e., the upper or lower  
492 threshold does not include 1) and Wald test were used.

### 493 **Method**

494 **Participants.** A total of 332 athletes (134 females and 198 males;  $M_{\text{age}} = 18.91$  years,  
495  $SD_{\text{age}} = 3.29$ ; range 13 - 37) participated in Study 5<sup>1</sup>. All participants were recruited from five  
496 elite sport training centers in China, and drawn from 16 different sports, comprising a variety of  
497 individual ( $n = 258$ ; e.g., archery, boxing, and weightlifting) and team ( $n = 74$ ; e.g., handball,  
498 synchronized swimming, and volleyball) disciplines. The majority of participants were

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<sup>1</sup> Data collection for Studies 2-4 occurred during March-October in 2013, whereas Study 5 data was obtained during August-September in 2015. Thus, due to logistical (e.g., mobility of athletes) and ethical considerations (e.g., we did not obtain ethical clearance to gather personal information from participants, as the research aims did not require us to do so), it is possible that some athletes from Studies 2-4 may have completed the DSS a second time in Study 5 but we are unable to provide an exact estimate.

499 competing at national levels ( $n = 262$ ), with some athletes competing or had competed at the  
500 international level ( $n = 70$ ). On average, athletes had participated in their sport competitively for  
501 6.27 years ( $SD = 3.58$ ; range 1 - 20).

## 502 **Measures.**

503 ***Decentering scale for sport.*** The 12-item DSS confirmed in Studies 3 and 4.

504 ***Athlete mindfulness questionnaire*** (AMQ; Zhang, Chung, & Si, in press). The AMQ is a  
505 16-item self-report questionnaire measuring athletes' levels of mindfulness during training and  
506 competition on three dimensions: present-moment attention (5 items; e.g., "I can maintain my  
507 attention on my training"), awareness (6 items; e.g., "During training or competition, I can be  
508 immediately aware of my emotional changes"), and acceptance (5 items; e.g., "During training  
509 and competition, it doesn't matter if the situation is good or bad, I can accept myself for who I  
510 am"). Items are rated on a five-point scale from 1 (*never true*) to 5 (*always true*). In the current  
511 study, the internal consistency reliabilities of the present-moment attention ( $\rho = .74$ ), awareness  
512 ( $\rho = .74$ ), and acceptance ( $\rho = .69$ ) are all acceptable.

513 ***Self-compassion scale*** (SCS; Neff, 2003b). The 13-item SCS that measures self-kindness  
514 (5 items; e.g., "I try to be loving towards myself when I'm feeling emotional pain"), common  
515 humanity (4 items; e.g., "I try to see my failings as part of the human condition"), and  
516 mindfulness (4 items; e.g., "When something painful happens I try to take a balanced view of the  
517 situation") was used in the current study. The SCS has been validated and used among Chinese  
518 populations (Kwan, Kuang, & Hui, 2009; Neff, Pisitsungkagarn, & Hsieh, 2008). Participants  
519 were asked to indicate how often they behave in the stated manner, on a 5-point scale that ranged  
520 from 1 (*almost never*) to 5 (*almost always*). In the present study, the internal consistencies of  
521 self-kindness, common humanity, and mindfulness were  $\rho = .67$ ,  $\rho = .61$ , and  $\rho = .63$ , respectively.



522            *Cognitive fusion questionnaire* (CFQ; Gillanders et al., 2014). The CFQ is a 7-item scale  
523 that measures psychological inflexibility in relation to cognitions. Items are rated on a seven-  
524 point scale from 1 (*never true*) to 7 (*always true*). For the CFQ, translation into Chinese and back  
525 translation into English procedure was closely followed (Hambleton, 2005). In the present study,  
526 the internal consistency of the Chinese CFQ is  $\rho = .85$ .

527            *Rumination-reflection questionnaire* (RRQ; Trapnell & Campbell, 1999). The RRQ  
528 measures two dimensions, rumination and reflection, on a 5-point scale that ranged from 1  
529 (*strongly disagree*) to 5 (*strongly agree*). Although both rumination and reflection involve  
530 heightened attention to self, we were only interested in the construct of rumination, which is  
531 described as “self-attentiveness motivated by perceived threats, losses, or injustices to the self”  
532 (Trapnell & Campbell, 1999, p. 297). Accordingly, a 9-item rumination subscale was used in the  
533 current study. The internal and test-retest reliabilities of the rumination subscale of the Chinese  
534 version RRQ in a sample of Chinese colleague students ( $n = 1226$ ) are  $\alpha = .81$  and  $r = .71$ ,  
535 respectively (Yuan, Peng, Huang, & Zhou, 2010).

536            **Procedures.** The data collection procedure was the same as those outlined in Studies 2,  
537 3, and 4.

### 538 **Data Analysis**

539            The percentage of missing data was negligible (1.11%) and were treated using pairwise  
540 deletion. The factorial validity of the measurement models of all measures in Study 5 were tested  
541 using CFA with Mplus 7 (Muthén & Muthén, 2012). We also examined the discriminant validity  
542 between the single-factor of decentering and factors of mindfulness and self-compassion by  
543 estimating a series of two-factor measurement models. Discriminant validity is demonstrated  
544 when the 95% confidence interval of factor correlations among latent factors does not include

545 unity (Bagozzi & Phillips, 1982). Further, discriminant validity between decentering and  
546 mindfulness as well as between decentering and self-compassion would be demonstrated if  
547 removing the constraint (i.e., correlations between factors were fixed to one) would lead to  
548 significant change of model fit using Wald's (1943) test (Bagozzi, Yi, & Phillips, 1991; Shiu,  
549 Pervan, Bove, & Beatty, 2011).

## 550 **Results and Discussion**

551 **Confirmatory factor analysis.** The 12-item unidimensional decentering model displayed  
552 an acceptable fit to the data:  $\chi^2(54) = 169.57, p < .001$ , CFI = .91, TLI = .89, WRMR = 1.07,  
553 RMSEA (90% CI) = .080 (.067, .094) and good internal consistency ( $\rho = .82$ ). The item means,  
554 standard deviations, standardized factor loadings and residuals are displayed in Table 1. Model  
555 fit indices of the criterion-related measures are displayed in Table 5.

556 **Concurrent and discriminant validities.** There were significant and medium to large  
557 negative correlations between the DSS and cognitive fusion as measured by the CFQ ( $r = -.21, p$   
558  $< .001$ ), but the correlation between decentering as measured by the DSS and rumination as  
559 measured by the RRQ ( $r = -.11, p > .05$ ) was not significant. All of the 95% confidence intervals  
560 of the latent factor correlations did not include 1, and the Wald test was significant ( $p < .001$ )  
561 thereby providing support for the discriminant validity of decentering with mindfulness and self-  
562 compassion (see Table 5).

## 563 **General Discussion**

564 The primary purposes of this multi-study project were to develop a questionnaire  
565 designed to assess the concept of decentering in the context of training and competition in sport,  
566 and evaluate the construct validity of this scale in multiple, independent samples of Chinese  
567 athletes. Given the debate regarding the dimensionality of the decentering construct, we were

568 able to examine whether decentering is best conceptualized as a unidimensional or  
569 multidimensional construct in an athletic population. A series of four related studies provided  
570 support for the validity and reliability of a unidimensional decentering measure, the Decentering  
571 Scale for Sport (DSS). Partial measurement invariance of the DSS was established across gender  
572 and sport type. The DSS demonstrated associations with theoretically meaningful criterion-  
573 related measures in expected directions thereby providing support for its convergent and  
574 concurrent validities. Additionally, the discriminant validity between decentering as measured by  
575 the DSS with mindfulness and self-compassion was established. Taken together, these findings  
576 indicate that the DSS is a psychometrically sound sport-specific decentering inventory.

577         The findings of this multi-study project support the notion that the DSS assesses a  
578 unidimensional construct of decentering in a sport context, which is in line with the construct  
579 dimension of decentering in the Experiences Questionnaire (EQ; Fresco, Moore et al., 2007).  
580 Given the concerns raised by researchers about the inclusion of self-compassion into the  
581 composition of the EQ (Forman et al., 2012; Gillanders et al., 2014), the initial pool of items  
582 were developed based on two facets of decentering, namely, the ability to distinguish thoughts  
583 from a sense of one's self and to engage with negative experiences without reacting to them. The  
584 discriminant validity between decentering and self-compassion provides support for our decision  
585 to exclude this content from the initial pool of items, and therefore support the notion that  
586 decentering and self-compassion are two independent constructs. However, it should be noted  
587 that the model-data fit indices of the three-factor measurement model of the SCS were below the  
588 recommended guidelines in our study, which is in line with the recent criticism of the problems  
589 with the psychometric validity of the SCS (e.g., López et al., 2015). Thus, caution is urged when  
590 interpreting the discriminant validity evidence between decentering and self-compassion as

591 reported in this study. Although other researchers have found two decentering dimensions using  
592 the EQ in different populations (Gecht, Kessel, Mainz et al., 2014; McCracken et al., 2014),  
593 results of this project obtained with multiple samples and using both exploratory and  
594 confirmatory analyses provided evidence for the unidimensional nature of the decentering  
595 construct (Gregório et al., 2015; Soler et al., 2014). As we did not include rumination items when  
596 developing the initial pool of decentering items, we further examined the association between  
597 DSS and rumination in Study 5. Given that rumination and decentering are viewed as two  
598 closely-related but opposite concepts, the negative but non-significant association between these  
599 two variables revealed in our study requires further investigation.

600         Researchers have attempted to differentiate decentering from similar concepts. For  
601 example, Gillanders and colleagues (2014) stated that, compared to decentering, cognitive  
602 defusion is a more narrowly defined and behaviorally oriented process, which is described as  
603 facilitating the action that is taken to be consistent with individual's values rather than changing  
604 metacognitive beliefs. Although re-perceiving is defined as a more cognitively oriented process  
605 after the mindfulness practice, decentering in the current study is defined from both the  
606 behaviorally and cognitively oriented perspectives, that is, (a) individuals cognitively  
607 differentiate one's thoughts one's true self and truth, and (b) behaviorally ceased the habitual  
608 reaction to one's experiences. In addition, it should be noted that many unidimensional self-  
609 report measures of cognitive defusion have been developed (e.g., Forman et al., 2012). This  
610 approach is in line with the findings of the current study and the development of EQ as a  
611 unidimensional construct (Fresco, Moore, et al., 2007). However, the negative and medium to  
612 large association ( $r = -.21$ ) between decentering and cognitive fusion (the opposite of cognitive  
613 defusion) suggests that decentering and cognitive defusion are conceptually similar but two

614 independent constructs. Although it can be argued that decentering, re-perceiving, and cognitive  
615 defusion are different constructs in terms of their theoretical origins, they also might be different  
616 names for the same construct. As such, in order to clarify the conceptual overlap or distinctions  
617 between these constructs (Hagger, 2014), further empirical and theoretical work is required to  
618 examine and compare the thematic and experiential meaning of these constructs. Although  
619 mindfulness and decentering are two closely-related concepts, it should be noted that decentering  
620 in the current project was conceptualized as an independent construct rather than a component of  
621 mindfulness (Lau et al., 2006), and the magnitude of their association in Studies 3 and 5  
622 supported this conceptualization. These findings are consistent with previous research that has  
623 shown mindfulness and decentering are two independent constructs (e.g., Gecht, Kessel,  
624 Forkmann et al., 2014).

625         In line with previous studies of decentering (Fresco, Moore, et al., 2007; Gregório et al.,  
626 2015), the current study revealed that decentering is positively associated with adaptive  
627 psychological characteristics such as mindfulness, well-being, flow, vitality, positive affect, and  
628 enjoyment, and inversely related with psychological characteristics such as experiential  
629 avoidance, athlete burnout, negative affect, and anxiety. The positive correlation between  
630 decentering and mindfulness and the negative association between decentering and experiential  
631 avoidance further corroborate their close associations. Given that the reduction of experiential  
632 avoidance in uncomfortable thoughts and emotions is central to mindfulness-based interventions  
633 for athletes (e.g., Gardner & Moore, 2004, 2007), further investigation into the reciprocal  
634 relations between mindfulness, decentering and experiential avoidance within a mindfulness-  
635 based intervention is necessary. Building on the established association between mindfulness and  
636 flow (e.g., Aherne, Aidan, & Lonsdale, 2011), a positive relation between decentering and

637 mindfulness and between decentering and flow suggests that the ability to adopt decentering  
638 might be related to the experience of flow during training and competition. Moreover, positive  
639 associations between decentering and subjective well-being, enjoyment, vitality, and positive  
640 affect, as well as the negative associations between decentering and negative affect, and anxiety  
641 indicate that interventions that target improving decentering capability might help foster adaptive  
642 and minimize maladaptive outcomes.

643         The DSS can be applied to the assessment of decentering in sport contexts in order to  
644 explore the effectiveness of various mental training programs as well as their potential changing  
645 mechanisms. For example, applying the DSS in different types of interventions (e.g., CBT,  
646 relaxation, and mindfulness interventions) can clarify the similarities and differences when  
647 utilizing these programs in athletes' mental training (e.g., Hayes-Skelton et al., 2015). The DSS  
648 can also be used to track the progress of change during interventions using the N-of-1  
649 randomized controlled trials (N-of-1 trials; Kazdin, 1982), in which time periods within each  
650 participant are randomly allocated to different conditions. The N-of-1 trials can serve as an  
651 alternative to between-subjects RCTs in applied sport contexts, in particular the small sample of  
652 athletes at the international level. Given that decentering has been proposed as one of the  
653 mechanisms of change in mindfulness-based interventions (Sauer & Baer, 2010) and cognitive  
654 behavioral therapy (Sanfran & Segal, 1990), the DSS may prove useful in allowing researchers  
655 to test the mediational role of decentering from mindfulness to adaptive and maladaptive  
656 psychological variables. Future research can use the DSS to examine whether decentering is a  
657 proximal or distal variable of mindfulness based therapies for flow, mood, anxiety and other  
658 psychological variables (e.g., Tanay, Lotan, & Bernstein, 2012).

659           Despite the adequate psychometric properties of the single-factor DSS, a number of  
660 limitations should be acknowledged that might also indicate directions for future research. In  
661 terms of the study samples, we only collected data from elite Chinese athletes. As such, future  
662 research should examine the extent to which the DSS generalizes to Western athletic  
663 populations. Secondly, the test-retest reliability of the DSS should be examined to provide  
664 insight into the traitness of this construct, and the predictive validity of the DSS can possibly be  
665 established by applying mindfulness training to increase positive and decrease negative  
666 psychological states. Thirdly, although we confirmed the unidimensional nature of decentering in  
667 the current study using athletic populations, future research should examine the dimensionality  
668 of the decentering construct further through validating the DSS and EQ using different  
669 populations or by developing new measurements based on the conceptualization of decentering  
670 (Safran & Segal, 1990). Fourthly, although decentering was conceptualized as a dispositional  
671 construct in our study, future research can design a state measure of decentering in sport contexts  
672 using the timeframe of right now, and examine levels of decentering immediately after  
673 mindfulness and or CBT practice. Fifthly, many of the validation questionnaires (e.g.,  
674 measurements of enjoyment, experiential avoidance, well-being, and vitality) employed in this  
675 project evidenced high RMSEA values over .10. Models with small degrees of freedom can have  
676 artificially large values of the RMSEA, such that some researchers propose not to compute the  
677 RMSEA for measurement models with low degrees of freedom (Kenny, Kaniskan, & McCoach,  
678 2015). Finally, although we conceptually differentiated decentering with similar concepts such as  
679 cognitive defusion and re-perceiving, further research is needed to clarify and synthesize this  
680 construct through testing of the similarities and differences of these concepts regarding the  
681 semantic and measurement levels (Hagger, 2014).

682           In conclusion, in this multi-study project we developed and offered initial validity  
683 evidence for a sport-specific tool to measure decentering in sport contexts using four separate  
684 samples of Chinese athletes. The unidimensional nature of the decentering construct has been  
685 confirmed, with satisfactory internal consistency reliability, and the establishment of convergent  
686 and concurrent validities. Future research can also pursue to confirm the dimensionality of the  
687 decentering construct the effectiveness of mindfulness and CBT training on decentering and to  
688 further examine its predictive validity on sport performance and adaptive and maladaptive  
689 psychological variables.

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Table 1

Factor Loading Matrix, Factor Loadings ( $\lambda$ ) and Error Variances ( $\theta$ ), Item Means ( $M$ ) and Standard Deviations ( $SD$ ), and Composite Reliabilities ( $CR$ ) of the DSS (Studies 2, 3, 4, and 5)

DSS items	Study 2: EFA ( $n = 271$ )		Study 3: CFA ( $n = 357$ )				Study 4: CFA ( $n = 295$ )				Study 5: CFA ( $n = 332$ )					
	Two factor		One factor		$M$	$SD$	$\lambda$	$\theta$	$M$	$SD$	$\lambda$	$\theta$	$M$	$SD$	$\lambda$	$\theta$
	F1	F2	$\lambda$	$\lambda$												
Item2	<b>.64*</b>	.24*	<b>.68*</b>		3.07	.89	.69	.52	3.23	.89	.59	.65	3.04	.87	.61	.62
Item5	<b>.53*</b>	.03	<b>.54*</b>		3.45	.87	.63	.61	3.53	.85	.42	.82	3.51	.89	.54	.71
Item4	<b>.61*</b>	.18*	<b>.64*</b>		3.15	.96	.60	.65	3.18	.88	.64	.59	2.94	.92	.38	.85
Item7	<b>.49*</b>	-.14	<b>.47*</b>		3.25	.95	.49	.76	3.26	.88	.52	.73	3.15	1.01	.45	.80
Item9	<b>.52*</b>	.15*	<b>.55*</b>		3.29	.94	.60	.64	3.38	.93	.64	.60	3.21	1.02	.61	.63
Item6	<b>.48*</b>	-.12	<b>.46*</b>		3.34	.98	.47	.78	3.21	.95	.47	.78	3.06	1.04	.39	.85
Item11	<b>.54*</b>	-.08	<b>.52*</b>		3.36	.90	.52	.73	3.22	.94	.47	.78	3.15	1.03	.43	.82
Item12	<b>.52*</b>	.23*	<b>.55*</b>		3.16	.93	.57	.68	3.17	.89	.50	.75	3.10	.98	.54	.71
Item14	<b>.51*</b>	.00	<b>.51*</b>		3.57	.97	.59	.65	3.53	1.03	.52	.73	3.58	1.05	.59	.65
Item18	<b>.66*</b>	-.03	<b>.65*</b>		3.22	.95	.74	.45	3.29	.96	.69	.52	3.15	1.06	.63	.60
Item19	<b>.62*</b>	-.03	<b>.61*</b>		3.54	.99	.66	.57	3.46	.97	.63	.60	3.40	1.06	.53	.72
Item20	<b>.57*</b>	.16*	<b>.60*</b>		3.48	.86	.57	.67	3.47	.89	.41	.84	3.39	.96	.50	.75
Item23	<b>.50*</b>	-.28*	<b>.43*</b>													
Item21	.34*	<b>-.38*</b>														
Item15 <sup>a</sup>	-.11*	<b>.48*</b>														
Item16 <sup>a</sup>	.00	<b>.79*</b>														
CR			.85				.88				.83				.82	

Note. DSS = Decentering Scale for Sport; EFA = exploratory factor analysis; CFA = confirmatory factor analysis; Items 23, 21, 15, and 16 were not included in the final 12-item DSS scale after EFA in Study 2 and CFA in Study 3. <sup>a</sup> = reverse-worded items. Numbers in bold face indicate primary loadings of EFA, with statistically significant ( $p < .05$ ) loadings are marked with an “\*”. All factor loadings of Studies 3, 4, and 5 are statistically significant at  $p < .05$ .

Tale 2

*Model-Fit Indices for Invariance Analysis of the DSS Measurement Model (Study 3; n = 357)*

Model	$\chi^2$	<i>df</i>	$\Delta \chi^2$	$\Delta df$	CFI	$\Delta CFI$	TLI	$\Delta TLI$	RMSEA	$\Delta RMSEA$
Gender										
Male	126.397	44			.960		.950		.073	
Female	99.540	44			.954		.943		.092	
CI	201.753	88			.950		.937		.085	
MI	276.351	141	101.633 <sup>*a</sup>	53	.940	-.010	.953	.016	.074	-.011
PMI(i2)	263.869	136	88.753 <sup>*b</sup>	48	.956	.006	.965	.028	.064	-.021
PMI(i2 and i11)	244.252	131	69.665	43	.950	.000	.958	.021	.070	-.015
FVI	222.298	132	2.047	1	.960	.010	.967	.009	.062	-.008
Sport Type										
Individual	131.035	44			.935		.919		.088	
Team	89.653	44			.944		.929		.100	
CI	219.574	88			.938		.922		.092	
MI	280.089	141	96.013 <sup>*c</sup>	53	.934	-.004	.949	.027	.074	-.018
PMI(i3)	249.768	136	66.631	48	.946	.008	.957	.035	.069	-.023
FVI	223.450	137	1.543	1	.959	.013	.967	.01	.060	-.009

*Note.* DSS = Decentering Scale for Sport; CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation; CI = configural invariance; MI = measurement invariance; PMI = partial measurement invariance; FVI = factor variance invariance. Item numbers (i4, i5 and i19) in the parenthesis refer to partial measurement invariance with their factor loadings and thresholds were estimated to be equal across sport type. <sup>\*a</sup> = statistically significant  $\Delta \chi^2$  statistic ( $p = .0002$ ) after a Bonferroni correction  $\alpha (.05/53) = .0009$ ; <sup>\*b</sup> = statistically significant  $\Delta \chi^2$  statistic ( $p = .0003$ ) after a Bonferroni correction  $\alpha (.05/48) = .001$ ; <sup>\*c</sup> = statistically significant  $\Delta \chi^2$  statistic ( $p = .0003$ ) after a Bonferroni correction  $\alpha (.05/53) = .0009$ . Given that  $\Delta \chi^2$  tests were conducted using DIFFEST procedure, the  $\Delta \chi^2$  is not equal to the difference in  $\chi^2$  between two models.

Table 3

*Means (M), Standard Deviations (SD), Composite Reliability (CR), and Model Fit Indices of All the Criterion-related Measures, and Latent Factor Correlations with the DSS (Study 3; n = 357)*

Scales	Descriptive statistics			Model fit Indices						Latent Correlations with DSS	
	<i>M</i>	<i>SD</i>	CR	$\chi^2$	<i>df</i>	CFI	TLI	RMSEA 90% CI	WRMR	<i>r</i>	95% CI
AAQ-II	21.02	7.91	.88	121.13***	14	.96	.93	.146 [.123, .171]	.998	-.30***	-.40, -.20
TCWS	24.88	6.65	.77	59.61***	9	.95	.92	.126 [.096, .157]	.853	.40***	.29, .50
MAAS	4.18	.69	.88	383.43***	90	.91	.90	.096 [.086, .106]	1.295	.27***	.17, .37
SDFS <sup>a</sup>	30.76	4.65	.79	34.41**	14	.98	.97	.064 [.037, .091]	.655	.54***	.45, .63

*Note.* DSS = Decentering Scale for Sport; AAQ-II = Acceptance and Action Questionnaire–II; MAAS = Mindful Attention Awareness Scale; TCWS = Training and Competition Well-being Scale; SDFS = Short Dispositional Flow Scale; CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation; CI = confidence invariance; WRMR = weighted root mean square residual. \*\* $p < .01$ ; \*\*\* $p < .001$ . <sup>a</sup> In our data, Items 2 and 8 of the SDFS were removed due to their low factor loadings (i.e.,  $\lambda < .30$ ).

Table 4

*Means (M), Standard Deviations (SD), Composite Reliability (CR), and Model Fit Indices of All the Criterion-related Measures, and Latent Factor Correlations with the DSS (Study 4; n = 295)*

Scales	Descriptive statistics			Model fit Indices						Latent Correlations with DSS	
	<i>M</i>	<i>SD</i>	CR	$\chi^2$	<i>df</i>	CFI	TLI	RMSEA 90% CI	WRMR	<i>r</i>	95%CI
ABQ				364.46***	87	.94	.93	.104 [.093, .115]	1.180		
RSA	13.28	3.50	.76							-.21**	-.32, -.08
Exhaustion	14.67	3.78	.82							-.05	-.18, .08
Devaluation	12.37	4.18	.87							-.05	-.17, .08
SVS	28.65	7.73	.91	99.08***	9	.97	.95	.185 [.153, .218]	.702	.25***	.13, .36
IPANAS-SF <sup>a</sup>				93.26***	26	.96	.94	.094 [.074, .115]	1.034		
PA	17.78	3.73	.84							.20***	.09, .32
NA	12.06	4.12	.76							-.17**	-.30, -.05
SES	15.60	3.70	.93	19.75***	2	1.00	.99	.173 [.109, .247]	.425	.18**	.06, .31
SCAT <sup>b</sup>	18.61	3.42	.80	33.70	27	.99	.99	.029 [.000, .057]	.643	-.19**	-.32, -.05

*Note.* DSS = Decentering Scale for Sport; ABQ = Athlete Burnout Questionnaire; RSA = Reduced Sense of Accomplishment subscale; SVS = Subjective Vitality Scale; PA = Positive Affect; IPANAS-SF = International Positive and Negative Affect Schedule Short Form; NA = Negative Affect; SES = Sport Enjoyment Scale; SCAT = Sport Competition Anxiety Test; CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation; CI = confidence invariance; WRMR = weighted root mean square residual. \*\* $p < .01$ ; \*\*\* $p < .001$ . <sup>a</sup> In our data, Item 3 of the IPANAS-SF was removed due to its low factor loading (i.e.,  $\lambda < .30$ ). <sup>b</sup> In our data, Item 8 of the SCAT was removed due to its low factor loading (i.e.,  $\lambda < .30$ ).

Table 5

*Means (M), Standard Deviations (SD), Composite Reliability (CR), and Model Fit Indices of All the Criterion-related Measures, and Latent Factor Correlations and Wald Tests with the DSS (Study 5; n = 332)*

Scales	Descriptive statistics			Model fit Indices						Latent Correlations with DSS		Wald Test
	<i>M</i>	<i>SD</i>	<i>CR</i>	$\chi^2$	<i>df</i>	CFI	TLI	RMSEA 90% <i>CI</i>	WRMR	<i>r</i>	95% <i>CI</i>	
AMQ				219.09***	101	.94	.93	.059 [.049, .070]	.989			
Attention	18.16	3.11	.74							.72***	.64, .80	47.79***
Awareness	21.41	3.68	.74							.57***	.47, .66	75.52***
Acceptance	16.96	3.07	.69							.77***	.70, .84	40.90***
SCS				261.41***	62	.85	.81	.099 [.087, .111]	1.340			
Self-kindness	15.71	3.69	.67							.49***	.38, .59	89.48***
Humanity	13.45	3.11	.61							.53***	.40, .66	52.22***
Mindfulness	13.60	2.99	.63							.69***	.60, .77	51.89***
CFQ	25.77	7.52	.85	60.51***	14	.97	.96	.101 [.076, .128]	.711	-.21***	-.32, -.10	
RRQ <sup>a</sup>	30.19	5.40	.81	84.22***	27	.95	.93	.081 [.061, .100]	.890	-.11	-.25, .03	

*Note.* DSS = Decentering Scale for Sport; AMQ = Athlete Mindfulness Questionnaire; SCS = Self-Compassion Scale; CFQ = Cognitive Fusion Questionnaire; RRQ = Rumination-Reflection Questionnaire; CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation; CI = confidence invariance; WRMR = weighted root mean square residual. \*\* $p < .01$ ; \*\*\* $p < .001$ .

<sup>a</sup> In our data, Items 6, 9, and 10 of the RRQ were removed due to their low factor loadings (i.e.,  $\lambda < .30$ ).

## 运动领域去自我中心量表

*Decentering Scale for Sport (DSS)*

1	2	3	4	5			
从来没有 Never true	很少这样 Rarely true	有时这样 Sometimes true	经常这样 Often true	总是这样 Always true			
在训练或比赛中..... During training and competition.....							
2. 我能够将自己从让人心烦的想法或画面中抽离出来, 不受其控制。 2. I can pull myself out of annoying thoughts or images without being controlled by them.			1	2	3	4	5
5. 我能够区分出哪些是当时客观真实情况, 哪些是自己内在想法。 5. I can distinguish thoughts which are objective reflections from those which are my personal thinking.			1	2	3	4	5
4. 我不会轻易地被自己的想法和情绪带着走。 4. I am not easily distracted by my thoughts and emotions.			1	2	3	4	5
7. 我注意到各种想法和感受只是短暂的, 而并非事实。 7. I notice that all kinds of thoughts and feelings are temporary, not necessarily the truth.			1	2	3	4	5
9. 我能够觉察到自己有不愉快的情绪出现, 但不会沉浸其中。 9. I can observe but not become immersed in unpleasant emotions.			1	2	3	4	5
6. 我能够只是意识到让人心烦的想法或画面, 而不立即表现出任何反应。 6. I can just be aware of the annoying thoughts or images, without immediately reacting to them.			1	2	3	4	5
11. 我提醒自己, 所感觉到的状态好与差未必会发生在实际情况中。 11. I remind myself that although I can feel good or bad states, the actual situation might not be like this.			1	2	3	4	5
12. 当出现让人心烦的想法或画面时, 我很快就会平静下来。 12. When annoying thoughts or images appear, I can calm down quickly.			1	2	3	4	5
14. 我注意到自己在面对困难和压力时的消极思考方式, 但明白自己并不是一个消极的人。			1	2	3	4	5



14. I notice the passive thinking style when I confront difficulty and pressures, while at the same time I understand that I am not a passive person.					
18. 我能够只是意识到让人心烦的想法或画面，不与其纠缠不清。 18. I can be aware of annoying thoughts or images without becoming entangled in them.	1	2	3	4	5
19. 我注意到焦虑不安的心情或负面的想法只是当下所感受到的，并不能代表全部的自己。 19. I notice that an agitated mood or negative thinking is not who I am or what the situation really looks like.	1	2	3	4	5
20. 我能够从容地对困难做出反应。 20. I can react to difficulties with calm.	1	2	3	4	5
*23. 我注意到认为自己无法再继续坚持下去只是一个想法和念头，而事实未必如此。 *23. I notice that what I think I cannot hold onto is just a thought or an idea, and not necessarily the truth.	1	2	3	4	5
*21. 我注意到对比赛结果的一切猜想和分析只是我自己的想法和念头，并且只会让比赛变得更加复杂。 *21. I realize that conjecture and analysis of the competition results are just my thoughts and ideas, which can make the competition more complicated.	1	2	3	4	5
* 15. 我控制不住自己的情绪不被负面想法和念头影响到。 * 15. I become emotionally affected by the negative thoughts and ideas on my emotions <sup>a</sup> .	1	2	3	4	5
* 16. 我虽然觉察到了自己的一些想法和念头是负面的，但还是控制不了不受影响。 * 16. Although I am aware of negative thoughts and ideas, I still cannot avoid being affected by them <sup>a</sup> .	1	2	3	4	5

*Note.* Items are marked with an “\*” were not included in the final 12-item DSS scale. <sup>a</sup> = Reverse-worded Items.