

Est.  
1841

YORK  
ST JOHN  
UNIVERSITY

Rumbold, James, Madigan, Daniel J.

ORCID logo ORCID: <https://orcid.org/0000-0002-9937-1818>,  
Murtagh-Cox, Alice and Jones, Leighton (2021) Examining Profiles  
of the Big Five and Sensation Seeking among Competitive  
Climbers. *Psychology of Sport and Exercise*, 55 (101951).

Downloaded from: <https://ray.yorks.ac.uk/id/eprint/5074/>

The version presented here may differ from the published version or version of record. If  
you intend to cite from the work you are advised to consult the publisher's version:

<https://www.sciencedirect.com/science/article/abs/pii/S1469029221000698>

Research at York St John (RaY) is an institutional repository. It supports the principles of  
open access by making the research outputs of the University available in digital form.  
Copyright of the items stored in RaY reside with the authors and/or other copyright  
owners. Users may access full text items free of charge, and may download a copy for  
private study or non-commercial research. For further reuse terms, see licence terms  
governing individual outputs. [Institutional Repository Policy Statement](#)

# RaY

Research at the University of York St John

For more information please contact RaY at [ray@yorks.ac.uk](mailto:ray@yorks.ac.uk)

1 Examining Profiles of the Big Five and Sensation Seeking among Competitive Climbers

2  
3 James L. Rumbold<sup>1</sup>, Daniel J. Madigan<sup>2</sup>, Alice Murtagh-Cox<sup>1</sup>, Leighton Jones<sup>1</sup>

4 <sup>1</sup>Sheffield Hallam University, UK

5 <sup>2</sup>York St John University, UK

6  
7  
8 **Accepted for publication on the 14<sup>th</sup> April, 2021.**

9  
10  
11 **Declaration of interests:** None

12 **Credit author statement**

13 JLR: Conceptualization, Data curation, Methodology, Formal analysis, Supervision, Original  
14 draft preparation, Reviewing and Editing. DJM: Software, Formal analysis, Reviewing and  
15 Editing. AMC: Investigation and Project administration. LJ: Original draft preparation,  
16 Reviewing and Editing.

17 **Acknowledgement**

18 The authors would like to thank Professor Tim Woodman for commenting on an earlier  
19 version of the data analysis of this study.

20 **Author Note**

21 Correspondence concerning this article should be addressed to James L. Rumbold,  
22 Sport and Human Performance Research Group, Sport and Physical Activity Research  
23 Centre, College of Health, Wellbeing and Life Sciences, Sheffield Hallam University,  
24 Collegiate Crescent, Sheffield, South Yorkshire, S10 2BP. United Kingdom. Email:  
25 J.Rumbold@shu.ac.uk

## 26 Abstract

27 The present study sought to identify distinct personality profiles in competitive climbers ( $N =$   
28 331,  $Mean\ age = 29.85$ ,  $SD = 10.92$ ), and also sought to explore whether these climbers  
29 differed in their sensation seeking tendencies based on these personality profiles. Employing  
30 a cross-sectional design, participants completed measures of the big five personality  
31 dimensions (agreeableness; conscientiousness; extraversion; neuroticism; openness to  
32 experience) and sensation seeking (boredom susceptibility; experience seeking; disinhibition;  
33 thrill and adventure seeking). Latent profile analysis identified four distinct big five  
34 personality profiles (Curious and Impulsive; Emotionally Unstable; Healthy; and Measured  
35 and Compliant). MANCOVA and follow-up ANCOVAs demonstrated significant differences  
36 between the four personality profiles in relation to thrill and adventure seeking, experience  
37 seeking, and disinhibition. The findings suggest that the identification of distinct personality  
38 profiles using a person-centred approach is a useful way of distinguishing and optimizing  
39 typical behaviors and preferences in adventure sports in the future.

40 *Keywords:* adventure sport, climbing, latent profile analysis, personality, risk taking.

## 41 Introduction

42 Understanding what characterizes a persons' involvement in specific sport and  
43 exercise activities has been of interest to psychologists for some time. A series of recent  
44 reviews highlights that the value of investigating personality traits is being reconsidered by  
45 many as an important endeavor (Allen et al., 2020; Hill & Madigan, 2017; Laborde et al.,  
46 2020; McEwan et al., 2019). Personality traits are associated with how people experience  
47 exercise (Jones et al., 2018), and have in various adventure sports been related to the  
48 experience of flow states (Boudreau et al., 2020); self-efficacy beliefs (Baretta et al., 2017);  
49 affect regulation (Castanier et al., 2010a); and injuries and risk-taking behaviors (Castanier et  
50 al., 2010b).

51 In the context of adventure sports, two common ways in which participation have  
52 been explained include the Five Factor Model (FFM; Costa & McCrae, 1992) of personality,  
53 and sensation seeking tendencies (Woodman et al., 2020). Sensation seeking is defined as the  
54 need for varied, novel and complex sensations and experiences and the willingness to take  
55 physical and social risks for the sake of such experience (Zuckerman, 1979). According to  
56 Zuckerman's (1979) theory of optimal levels of arousal, the life activities that people choose  
57 can generally be predicted by individuals' preferences for optimal levels of stimulation for  
58 activities and positive affect. Under *normal* activities, Zuckerman (1983) hypothesized that  
59 high sensation seekers would feel continuously under aroused and therefore need greater  
60 stimulation in order to reach their optimal level of arousal. Subsequently, hedonic allostasis  
61 theory (Koob & Le Moal, 1997) proposed that certain behaviors (i.e., sensation seeking) arise  
62 in response to hypoactivity in dopamine systems and aim to restore one's normal hedonic  
63 tone. Studies have also highlighted the role of motivational processing since sensation  
64 seeking may be driven by hyperactive approach (Joseph et al., 2009), or hypoactive  
65 avoidance brain systems (Zheng et al., 2019). In this regard, high sensation seekers may

66 display a lower sensitivity to experiencing adverse consequences in potentially dangerous but  
67 rewarding activities (i.e., a hyperactive approach system). In contrast, low sensation seekers  
68 may display an enhanced sensitivity to achieving their desired outcomes in the presence of  
69 risk or potential loss (i.e., a hypoactive avoidance system).

70         Although sensation seeking is considered a distinct personality construct, there is  
71 some evidence that it shares a large amount of variance with the big five personality factors  
72 (Castanier et al., 2010b; de Vries et al., 2009; McEwan et al., 2019; Russo et al., 2012).  
73 Specifically, psychology literature has concluded that sensation seeking shares a large  
74 proportion of variance with extraversion, openness to experience, and, to a lesser degree,  
75 conscientiousness and agreeableness (de Vries et al., 2009). Neuroticism on the other hand  
76 has been shown to share very little variance with sensation seeking (Russo et al., 2012).  
77 Conversely, in a recently published mapping review of personality studies in sport and  
78 exercise psychology (Laborde et al., 2020), it was concluded that traits related to sensation  
79 seeking were closely connected in definition to personality facets of: neuroticism (e.g.,  
80 impulsiveness); extraversion (e.g., excitement seeking); and conscientiousness (e.g.,  
81 deliberation). Furthermore, conscientiousness has been shown to have an inverse relationship  
82 with total sensation seeking (Jones et al., 2018) and risk-taking behaviors (Woodman et al.,  
83 2020).

84         Collectively, these findings highlight that shared variance may exist between the big  
85 five personality factors and sensation seeking within and beyond sport and exercise  
86 psychology domains. However, these findings could be a consequence of the nomothetic  
87 methodological approach that is often adopted in assessing these relationships (de Vries et al.,  
88 2009). Several studies have assessed the individual contribution of some or all FFM domains  
89 in predicting outcomes independently of one another (e.g., Breivik et al., 1998; Russo et al.,  
90 2012; for a review, see McEwan et al., 2019). This methodological approach is somewhat

91 unhelpful not least because the big five are highly correlated and therefore previous findings  
92 may unintentionally be the result of issues with multicollinearity. Moreover, in an applied  
93 context, people participating in sport and exercise may be more likely to exhibit a *profile* of  
94 the big five rather than exhibiting high scores in one of the domains and not the others (cf.  
95 Bleidorn et al., 2020; de Vries et al., 2009). Understanding whether personality profiles exist  
96 in certain adventure sports, such as climbing, can provide coaches and practitioners with an  
97 idiographic insight into why some climbers may approach or avoid challenging maneuvers,  
98 and why some climbers may consistently be at greater risk of injury than others. Moreover,  
99 identifying climbers' personality profiles may distinguish differences in their sensation  
100 seeking tendencies. In turn, this could provide new understanding on how interventions could  
101 be promoted in this specific adventure sport, to enhance safety education for some target  
102 groups whilst optimizing perception of gain during risky maneuvers for others.

103         The current study positions the importance of a person-centred approach (Marsh et al.,  
104 2009) to understanding the big five and its relationship to sensation seeking tendencies. A  
105 person-centred approach is a technique for identifying and describing subgroups of  
106 individuals (e.g., climbers) who are defined by similarities and differences in  
107 multidimensional constructs (e.g., personality) (Gustafsson et al., 2016). This may provide an  
108 advantage over traditional variable-centred techniques (e.g., regression) as it could enable the  
109 identification of personality profiles to which individuals may belong. Furthermore, by  
110 identifying such subgroups and how they relate to, for example, sensation seeking tendencies,  
111 psychologists can use this information to transition away from cross-sectional designs to  
112 assess idiographic changes over time, as well as shape the development and evaluation of  
113 interventions for target groups.

114         In this study, we place greater emphasis on a person's interconnected personality  
115 profile rather than the independent assessment of separate variables. In doing so, we treat the

116 construct of the FFM as a multidimensional interrelated construct (de Vries et al, 2009). The  
117 first purpose of this study was to explore whether distinct profiles can be identified among  
118 competitive climbers on the FFM domains using latent profile analysis (LPA). In comparison  
119 to cluster analysis, LPA has the advantage of calculating probability estimates of group  
120 membership and fit indices to more reliably differentiate between multiple profile solutions  
121 (Marsh et al., 2009). A second purpose was to explore whether distinct personality profiles  
122 amongst the climbers differed in relation to their sensation seeking tendencies. Informed by  
123 extant literature examining person-centred approaches to understanding the FFM model (e.g.,  
124 Bleidorn et al., 2020; de Vries et al, 2009), we expected that personality profiles would  
125 emerge, and may differentiate climbers in relation to their specific sensation seeking  
126 tendencies.

## 127 **Method**

### 128 **Participants and Procedure**

129 Following institutional ethics approval, a sample of 331 climbers (51% male, 49%  
130 female; 89% British nationality) was recruited through national climbing clubs and  
131 organizations<sup>1</sup>. These organizations were initially contacted by email, informed of the  
132 purpose of the study, and asked to share an online questionnaire with their members via their  
133 official club webpages and social media. Prior to completing the online questionnaire,  
134 participants were provided with an online information sheet and consent form, which  
135 explained the study, clarified the anonymity and confidentiality of the data to be collected,  
136 and reminded participants of their right to withdraw from the study at any time. A priori

---

<sup>1</sup> Climbing involves using one's body to ascend a steep landscape (natural or man-made) object. The activity is carried out for recreational and competitive purposes and can be completed indoors and outdoors. There are a vast range of climbing activities that individuals participate in. A selection of these types of climbing activity include: Bouldering; building; free climbing; ice climbing; mountaineering; rope climbing; scrambling; sport climbing; and traditional climbing. Each climbing activity can typically be distinguished by the chosen climbing area and environment, and the degree to which safety equipment is used for safety purposes only, or to also assist in climbing progress (Cinnamon, 2000).

137 power analysis using G\*Power 3.01 indicated that a minimum sample size of 305 would be  
138 appropriate to detect a small effect size ( $f^2 = 0.02$ ) based on a power value of .90 and an alpha  
139 of 0.05. This power analysis was also determined on the basis of hypothesizing five distinct  
140 big five personality classes from the latent class profile analysis to be conducted. A minimum  
141 sample size of 305 is approximately in line with previous psychology literature examining the  
142 same construct relationships (personality and sensation seeking) with undergraduate student  
143 populations (de Vries et al., 2009). We therefore originally targeted a sample size of over 340  
144 to account for a 10% dropout and / or data missing at random. Climbers' mean age was 29.85  
145 years ( $SD = 10.92$ ) with an average of 9.42 years of experience ( $SD = 8.80$ ) and they  
146 identified bouldering (48%), sport climbing (27.5%), or traditional climbing (23.3%) as their  
147 main form of competitive participation. Fifty-three percent chose outdoor climbing as their  
148 main form of climbing environment.

#### 149 **Measures**

150 An online questionnaire (Qualtrics) was administered to collect demographic  
151 information and responses to the big five personality domains, and sensation seeking  
152 tendencies. This questionnaire took approximately 10 minutes to complete. All subscales  
153 demonstrated acceptable internal consistency (i.e., Cronbach's alpha  $> .70$ ; Nunnally, 1978).

154 **Big five personality domains.** The International Personality Item Pool (IPIP:  
155 Goldberg et al., 2006) version of the revised NEO personality inventory (NEO-PI-R: Costa &  
156 McCrae, 1992) provided 10 items each for extraversion ( $\alpha = 0.87$ ; "I feel comfortable around  
157 people"); neuroticism ( $\alpha = 0.87$ ; "I often feel blue"); conscientiousness ( $\alpha = 0.79$ ; "I carry out  
158 my plans"); agreeableness ( $\alpha = 0.72$ ; "I believe that others have good intentions"); and  
159 openness to experience ( $\alpha = 0.75$ ; "I have a vivid imagination"). Previous research supports  
160 the reliability and validity of the five subscales (Jones et al., 2018; Rumbold et al., 2020).  
161 Participants rated the extent to which each item described them accurately on a 5-point scale



162 (1 = “strongly disagree”, 5= “strongly agree”).

163         **Sensation seeking.** The Sensation Seeking Scale - Form V (SSS V; Zuckerman,  
164 Eysenck, & Eysenck, 1978) measures a person’s general preferences for thrill and adventure  
165 seeking (10 items;  $\alpha = 0.97$ ; “I sometimes like to do things that are a little frightening”);  
166 experience seeking (10 items;  $\alpha = 0.71$ ; “I like to explore a strange city or section of town by  
167 myself even if it means getting lost”); disinhibition (8 items;  $\alpha = 0.96$ ; “I like to have new and  
168 exciting experiences and sensations even if they are a little frightening / unconventional”);  
169 and boredom susceptibility (10 items;  $\alpha = 0.71$ ; “I get bored seeing the same old faces”).  
170 Each of the 38 items contained two statement choices. Participants were asked to select the  
171 statement that best described their likes or the way they feel. Two items were omitted due to a  
172 pilot test indicating high participant non-completion due to the perceived homophobic nature  
173 of these items. The four subscales have demonstrated satisfactory to good internal  
174 consistency in previous studies (e.g., Frenkel et al., 2019; Roberti et al., 2003).

### 175 **Data Analysis**

176         Initial data screening, descriptive statistics, alpha coefficients, bivariate, and biserial  
177 correlations (see Table 1) were calculated using IBM SPSS Statistics version 24. Latent  
178 profile analysis (LPA) was then conducted with *Mplus* version 7.3 (Muthén & Muthén, 1998-  
179 2012) to identify consistent profiles within the sample based on their big five personality  
180 domain scores (Marsh et al., 2009). The benefit of this approach is that class membership to  
181 specific big five domain interactions can be inferred from the relationship between a person’s  
182 agreeableness; conscientiousness; extraversion; neuroticism; and openness to experience.  
183 Moreover, these classes can be used to examine individual differences in competitive  
184 climbers’ sensation seeking preferences. We followed the recommendations of previous  
185 studies that have employed LPA and used the following criteria to assess best model fit:  
186 Bootstrap Likelihood Ratio Test (BLRT); Bayesian Information Criteria (BIC); Sample Size-

187 Adjusted BIC (SSABIC); entropy values; and, the average latent class probabilities for each  
188 profile solution (e.g., for a more detailed explanation, see Gustafsson et al., 2016; Marsh et  
189 al., 2009). We used 500 random start values for each model, with the 50 best retained for the  
190 final solution. We then applied 1500 random start values to avoid local maxima (cf.  
191 Gustafsson et al 2016).

192 Multivariate analysis of covariance (MANCOVA) was used to examine differences  
193 between big five personality profiles in terms of sensation seeking, whilst including sex as a  
194 covariate. Sex was included as a covariate since previous research has underlined that  
195 sensation seeking tendencies may differ between males and females (Cross et al., 2013;  
196 Zuckerman, 1979; Zuckerman et al. 1978). Our biserial correlations also showed that sex was  
197 related to all sensation seeking subscales (see Table 1).

## 198 Results

### 199 Latent Profile Analysis of the Big Five

200 Table 2 shows the model fit statistics and profile membership distribution of  
201 participants for the big five personality domains. Average posterior probabilities for the final  
202 four-profile model chosen were as follows: class 1 = 0.83; class 2 = 0.82; class 3 = 0.75; and  
203 class 4 = 0.78. Figure 1 illustrates the plot of four distinct big five personality profiles in the  
204 competitive climbers sampled ( $N = 331$ ). Class 1 climbers ( $n = 62$ ) were characterized by  
205 relatively high scores on extraversion, conscientiousness, agreeableness and openness to  
206 experience, whilst displaying relatively low scores on neuroticism. In so far that this profile  
207 shared strong similarities to a *healthy personality index* (Bleidorn et al., 2020), we labelled  
208 this class the Healthy climber. In contrast, class 2 ( $n = 56$ ) displayed the highest scores on  
209 neuroticism and the lowest scores on the remaining big five domains. For these reasons, we  
210 labelled class 2 the Emotionally Unstable climber. Class 3 ( $n = 106$ ) were characterized by  
211 displaying low-moderate scores on extraversion, neuroticism and openness to experience,

212 whilst displaying moderate-high scores on conscientiousness and agreeableness. We therefore  
213 labelled class 3 the Measured and Compliant climber, in line with consistently recognized  
214 facet descriptions of conscientiousness and agreeableness (Costa & McCrae, 1992; Goldberg  
215 et al., 2006). Conversely, class 4 climbers ( $n = 107$ ) had relatively high scores on openness to  
216 experience, and moderate levels of extraversion and neuroticism, whilst displaying lower  
217 scores for conscientiousness and agreeableness in comparison to other profiles. We labelled  
218 class 4 the Curious and Impulsive climber on the basis that most models of openness to  
219 experience include curiosity-related facets (Silvia & Christensen, 2020), and impulsiveness  
220 seems to contain facets of both neuroticism and extraversion (Laborde et al., 2020) (for  
221 means and standard errors, please see Table 3).

### 222 **Big Five Profile Differences in Sensation Seeking**

223 MANCOVA showed significant differences between the four different profiles on  
224 sensation seeking, Pillai's Trace (12, 966) = 5.48,  $p < .001$ . Follow-up univariate tests  
225 confirmed differences between profiles for the following sensation seeking variables: thrill  
226 and adventure seeking,  $F(3, 323) = 2.74$ ,  $p < .05$ ,  $\eta^2 = 0.02$ ; experience seeking,  $F(3, 323) =$   
227  $19.86$ ,  $p < .001$ ,  $\eta^2 = 0.15$ ; and, disinhibition,  $F(3, 323) = 5.38$ ,  $p < .001$ ,  $\eta^2 = 0.05$ . No  
228 significant differences between personality profiles and boredom susceptibility were found,  $F$   
229  $(3, 323) = 2.12$ ,  $p = .10$ ,  $\eta^2 = 0.02$ .

230 Post-hoc comparisons (with Hochberg adjustment) for personality profiles on  
231 sensation seeking subscales showed that for thrill and adventure seeking, Healthy climbers  
232 reported significantly higher scores than Emotionally Unstable climbers ( $p = .05$ ). For  
233 experience seeking, five of the six post-hoc comparisons showed statistically significant  
234 differences (see Table 4). Healthy climbers had higher ratings for experience seeking than  
235 Emotionally Unstable ( $p = .000$ ) and Measured and Compliant climbers ( $p = .001$ ),  
236 respectively. Emotionally Unstable climbers showed lower scores for this variable than

237 Measured and Compliant ( $p = .04$ ) and Curious and Impulsive climbers ( $p = .000$ ),  
238 respectively. In addition, Measured and Compliant climbers reported lower experience  
239 seeking tendencies than Curious and Impulsive climbers ( $p = .000$ ). For disinhibition,  
240 Curious and Impulsive climbers had significantly higher scores than Emotionally Unstable  
241 climbers ( $p = .01$ ) and Measured and Compliant ( $p = .02$ ) respectively. Finally, significant  
242 differences in sensation seeking were also found for sex as a covariate, Pillai's Trace (4, 320)  
243  $= 7.28, p < .001$ . Follow-up univariate tests showed that males rated themselves higher than  
244 females for boredom susceptibility,  $F(1, 323) = 16.40, p < .001, \eta^2 = 0.05$ ; experience  
245 seeking,  $F(1, 323) = 7.99, p < .01, \eta^2 = 0.02$ ; disinhibition,  $F(1, 323) = 7.35, p < .01, \eta^2 =$   
246  $0.02$ ; and, thrill and adventure seeking,  $F(1, 323) = 10.18, p < .01, \eta^2 = 0.03$ .

#### 247 **Discussion**

248 To our knowledge, this is the first study that has taken a person-centred approach to  
249 exploring whether distinct big five personality profiles could be identified among competitive  
250 climbers. Our findings identified four separate personality profiles: Healthy; Emotionally  
251 Unstable; Measured and Compliant; and Curious and Impulsive climbers. A second  
252 exploratory aim sought to examine whether these personality profiles would differ on  
253 sensation seeking tendencies. The findings showed significant differences between the  
254 personality profiles on three of the four sensation seeking subscales. The Healthy climbers  
255 displayed higher ratings on the thrill and adventure seeking, and experience seeking subscales  
256 in comparison to the Emotionally Unstable climbers, respectively. This represents an  
257 important finding since the Healthy profile shares a strong resemblance to a recently  
258 developed *healthy personality index*. This *healthy personality index* has been found to be  
259 positively correlated with psychological adjustment, self-esteem, self-regulation, immunity to  
260 stress, and an optimistic outlook (Bleidorn et al., 2020). This contrasts previously held views  
261 on sensation seeking whereby many of the subscales were considered to be indicative of

262 pathological functioning (Zuckerman, 1979).

263         In identifying different personality profiles, these findings help to suggest that higher  
264 scores on some sensation seeking subscales may be experienced by competitive climbers who  
265 display a healthy, normative personality profile in comparison to those who may not (i.e.,  
266 Emotionally Unstable climbers). These profiles go some way to supporting theoretical  
267 assertions that sensation seeking may be driven by a hyperactive approach (Joseph et al.,  
268 2009) or hypoactive avoidance brain system (Zheng et al., 2019). In the presence of potential  
269 rewards and risks whilst climbing, approach systems may be expressed in the forms of  
270 greater openness to experience, extraversion, and conscientiousness, whilst avoidance  
271 systems may manifest themselves through greater expression of neuroticism than other  
272 personality domains. This could have important applied implications for providing new  
273 understanding on how coaches and practitioners could support climbing profile groups who  
274 may be more likely to avoid difficult maneuvers, or ‘freeze’ during climbing events.

275         In challenging the view that high-risk sport participants can be considered a  
276 homogenous sensation-seeking group regardless of adventure sport (Barlow et al., 2013), our  
277 findings extend current knowledge by illustrating how heterogenous personality profiles can  
278 exist within a single high-risk sport, and how these groups may report similar or different  
279 levels of sensation seeking. For example, the Healthy, and Curious and Impulsive groups  
280 showed no statistically significant differences in any of the sensation seeking subscales,  
281 whilst both reporting high scores for thrill and adventure seeking, and experience seeking.

282         When exploring the big five composition differences between the Healthy and  
283 Curious and Impulsive groups, it was observed that both profiles displayed similarly high  
284 levels of openness to experience, and moderate or high levels of extraversion. This would  
285 suggest that openness to experience is the most salient big five factor that determines high  
286 levels of sensation seeking in climbers, but the degree to which this is the case might also

287 depend on possessing a moderate or high level of extraversion, conscientiousness, and  
288 agreeableness (most likely in that order of importance). This is justified by psychology  
289 studies that have used relative weight analysis to demonstrate that openness to experience,  
290 extraversion, and conscientiousness contribute the most variance in sensation seeking, in  
291 comparison to agreeableness and neuroticism (de Vries et al., 2009). Moreover, in the current  
292 study, a comparison of the Healthy and Curious and Impulsive groups highlights that  
293 possessing moderate levels of neuroticism may not prevent climbers from enacting high  
294 sensation seeking. Rather, it is the amalgamation of neuroticism with moderate-to-high levels  
295 of extraversion and openness to experience that seems to be associated with higher sensation  
296 seeking tendencies. From an applied perspective, these nuanced profile differences between  
297 the Healthy and Curious and Impulsive groups could be highly visible for coaches to identify  
298 during training, or referees and spectators at competitive events. This is because the moderate  
299 neuroticism that the Curious and Impulsive group display could manifest itself by way of  
300 poorly timed decision making in dangerous climbing circumstances, or fear and panic  
301 following a spontaneous decision. From a theoretical perspective, the Curious and Impulsive  
302 group and their subsequent behaviors could sit somewhere in between a hyperactive and  
303 hypoactive avoidance system of sensation seeking during competitive events.

304 Our findings also extend current knowledge on person-centred approaches to  
305 understanding personality differences in sensation seeking-related behaviors. In a study by  
306 Castanier et al. (2010b), the authors examined personality differences in risk-taking behaviors  
307 across various high-risk sports. Their cluster analysis findings showed that risk-taking  
308 behaviors, such as experiencing frequent accidents due to irresponsible behavior, and taking  
309 too many risks when practicing high-risk sports, were the highest in groups displaying low  
310 conscientiousness, and high or low combinations of extraversion and neuroticism. These risk-  
311 taking behaviors share some similarities to items from the thrill and adventure seeking

312 subscale of sensation seeking (e.g., “I can’t understand people who risk their necks climbing  
313 mountains”). From an applied perspective, this person-centred approach provides an  
314 advantage over variable-centred techniques (e.g., regression) in identifying subgroup profiles  
315 from a sampled population that could lead to tailored subgroup interventions. The Castanier  
316 et al. (2010b) study, however, did not examine group membership of all five personality  
317 domains, nor was it clear how participants were reliably assigned to group memberships for  
318 high / low profiles of conscientiousness, extraversion, and neuroticism in specific sports.  
319 Using a latent profile analysis, we extend these findings by reliably demonstrating the  
320 importance of identifying different big five profiles containing high levels of openness to  
321 experience in predicting high sensation seeking. We also highlight that high levels of  
322 sensation seeking can be seen in groups displaying moderate to high levels of  
323 conscientiousness and agreeableness as well, particularly when accompanied by high levels  
324 of extraversion.

### 325 **Applied Recommendations**

326         The findings of the present study have important applied implications for coaches and  
327 sport psychologists working with competitive climbers, because they suggest that different  
328 personality profiles may be able to distinguish between higher and lower degrees of sensation  
329 seeking. From a theoretical standpoint, this may suggest that some climbers could have a  
330 greater tolerance to how they approach or avoid potential risks and rewards from  
331 participating in this adventure sport (Joseph et al., 2009; Zheng et al., 2019). Identifying how  
332 an individual’s personality profile is linked to one’s sensation seeking tendencies in climbing  
333 could provide greater understanding of how training interventions could be promoted to  
334 improve safety education. For example, training could look to reinforce one’s perception of  
335 negative consequences. This approach could be suitable for specific groups (e.g., a Curious  
336 and Impulsive profile) who may lack inhibition from completing risky maneuvers, or lack an

337 ability to sensibly comply with regulating their activation of dangerous activities.

338         Furthermore, knowledge of subgroup personality profile differences could lead to  
339 developing cognitive-behavioral programs designed to improve one's perception of  
340 reward/gain. Such an approach could be appropriately shaped for specific groups (e.g., an  
341 Emotionally Unstable profile) who may be more hesitant and 'freeze' on a climbing wall  
342 when completing potentially threatening maneuvers. Taken together, coaches and  
343 psychologists could seek to establish the profiles of novice sportspersons and then seek to  
344 tailor their training experiences accordingly. In the context of the present findings, coaches  
345 could look to offer Curious and Impulsive climbers a more expansive range of experiences  
346 (aligned to greater disinhibition) than Measured and Compliant climbers. The longer-term  
347 effects of such an approach could then be examined in relation to climbers' enjoyment and  
348 engagement over time.

#### 349 **Limitations and Future Research**

350         First, latent profile analysis was conducted on the big five personality *domains*.  
351 Although sport and exercise psychology researchers often examine the FFM domains in  
352 relation to various well-being and performance outcomes (Allen et al., 2020; Rumbold et al.,  
353 2020), an examination at the *facet* level may provide a more nuanced explanation of how  
354 personality profiles are linked to sensation seeking tendencies or other outcome variables in  
355 the future (Laborde et al., 2020). Second, we acknowledge the limitation of sampling one  
356 sport, which prevents generalizability to other adventure sports. Future research could seek to  
357 apply a latent profile analysis to other adventure sports to determine whether similar  
358 personality profiles emerge. This is particularly important in light of evidence that  
359 comprehensively challenges the view that high-risk sport participants can be considered a  
360 homogenous sensation-seeking group (Barlow et al., 2013). Third, we agree that research on  
361 personality in sport and physical activity needs to transition away from cross-sectional



362 designs (Allen et al., 2020; Laborde et al., 2020). For example, researchers could  
363 longitudinally examine how participation in sport and exercise might contribute to stability or  
364 change in personality. In addition, prospective designs could be used to assess how  
365 personality traits may explain changes in people's enjoyment of sport and physical activities  
366 (Jackman et al., 2020). Our findings would also suggest that it may be worthwhile to continue  
367 to examine gender differences in future work when examining sensation seeking-related  
368 experiences over time. Although our findings support previous research that has identified  
369 sex differences in sensation seeking tendencies (e.g., Cross et al., 2013; Zuckerman et al.  
370 1978), other research suggests that this may not always be the case (e.g., McEwan et al.,  
371 2019). Finally, we acknowledge that the sensation seeking scale (SSS V; Zuckerman,  
372 Eysenck, & Eysenck, 1978) adopted in this study does not imply that sensation seeking is a  
373 motive for participation in high-risk sports (Woodman et al., 2020). It was not our intention  
374 in this study to assess sensation seeking as a proxy for motives for participation in  
375 competitive climbing, however, future research could look to adopt a person-centred  
376 approach in identifying variance in participation motives within and between high-risk sports.

### 377 **Conclusion**

378 In summary, the findings of this study contribute to an in-depth understanding of  
379 individual differences in relation to sensation seeking tendencies in the specific high-risk  
380 sport of competitive climbing. The latent profile analysis approach provided a reliable way of  
381 differentiating between big five personality profile memberships, and enabled us to  
382 demonstrate that various combinations of the big five seem to provide greater examples of  
383 high sensation seeking tendencies in this climbing sample than others. Continuing with a  
384 person-centred approach towards personality research in the future may be useful in  
385 developing individually tailored interventions to engage people in particular sport activities  
386 safely, and, to optimize their experience in a healthy and personally meaningful way.

## 387 References

- 388 Allen, M. S., Mison, E. A., Robson, D. A., & Laborde, S. (2020). Extraversion in sport: A scoping  
389 review. *International Review of Sport and Exercise Psychology*. Advance online  
390 publication. <https://doi.org/10.1080/1750984X.2020.1790024>
- 391 Baretta, D., Greco, A., & Steca, P. (2017). Understanding performance in risky sport: The role of  
392 self-efficacy beliefs and sensation seeking in competitive freediving. *Personality and  
393 Individual Differences, 117*, 161-165. <http://dx.doi.org/10.1016/j.paid.2017.06.006>
- 394 Barlow, M., Woodman, T., & Hardy, L. (2013). Great expectations: Different high-risk activities  
395 satisfy different motives. *Journal of Personality and Social Psychology, 105*(3), 458-475.  
396 <http://dx.doi.org/10.1037/a0033542>
- 397 Bleidorn, W., Hopwood, C. J., Ackerman, R. A., Witt, E. A., Kandler, C., Riemann, R., Samuel,  
398 D. B., & Donnellan, M. B. (2020). The healthy personality from a basic trait perspective.  
399 *Journal of Personality and Social Psychology, 118*(6), 1207-1225.  
400 <http://dx.doi.org/10.1037/pspp0000231>
- 401 Boudreau, P., Mackenzie, S. H., & Hodge, K. (2020). Flow states in adventure recreation: A  
402 systematic review and thematic synthesis. *Psychology of Sport and Exercise, 46*, 101611.  
403 Advance online publication. <https://doi.org/10.1016/j.psychsport.2019.101611>
- 404 Breivik, G., Roth, W. T., & Jorgensen, P. E. (1998). Personality, psychological states and heart  
405 rate in novice and expert parachutists. *Personality and Individual Differences, 25*, 365-  
406 380.
- 407 Castanier, C., Le Scanff, C., & Woodman, T. (2010a). Beyond sensation seeking: Affect  
408 regulation as a framework for predicting risk-taking behaviors in high-risk sport. *Journal  
409 of Sport and Exercise Psychology, 32*, 731-738. <https://doi.org/10.1123/jsep.32.5.731>
- 410 Castanier, C., Le Scanff, C., & Woodman, T. (2010b). Who takes risks in high-risk sports? A  
411 typological personality approach. *Research Quarterly for Exercise and Sport, 81*, 478-484.

- 412 <https://doi.org/10.1080/02701367.2010.10599709>
- 413 Cinnamon, J. (2000). *The complete climber's handbook* (2nd ed.). Ragged Mountain.
- 414 Costa, P. T., Jr., & McCrae, R. R. (1992). *Revised NEO Personality Inventory (NEO-PI-R) and*  
415 *NEO Five-Factor Inventory (NEO-FFI) professional manual*. Psychological Assessment  
416 Resources.
- 417 Cross, C. P., Cyrenne, D. L., & Brown, G. R. (2013). Sex differences in sensation-seeking: A  
418 meta-analysis. *Scientific Reports*, 3, 2486. <https://doi.org/10.1038/srep02486>
- 419 de Vries, R. E., de Vries, A., & Feij, J. A. (2009). Sensation seeking, risk-taking, and the  
420 HEXACO model of personality. *Personality and Individual Differences*, 47, 536-540.  
421 <https://doi.org/10.1016/j.paid.2009.05.029>
- 422 Frenkel, M. O., Brokelmann, J., Nieuwenhuys, A., Heck, R-B., Kasperk, C., Stoffel, M., &  
423 Plessner, H. (2019). Mindful sensation seeking: An examination of the protective influence  
424 of selected personality traits on risk sport-specific stress. *Frontiers in Psychology*,  
425 10:1719. <https://doi.org/10.3389/fpsyg.2019.01719>
- 426 Gustafsson, H., Hill, A. P., Stenling, A., & Wagnsson, S. (2016). Profiles of perfectionism,  
427 parental climate, and burnout among competitive junior athletes. *Scandinavian Journal of*  
428 *Medicine & Science in Sports*, 26, 1256-1264. <https://doi.org/10.1111/sms.12553>
- 429 Goldberg, L. R., Johnson, J. A., Eber, H. W., Hogan, R., Ashton, M. C., Cloninger, C. R., &  
430 Gough, H. C. (2006). The International Personality Item Pool and the future of public-  
431 domain personality measures. *Journal of Research in Personality*, 40, 84-96.  
432 <https://doi.org/10.1016/j.jrp.2005.08.007>
- 433 Hill, A. P., & Madigan, D. J. (2017). A short review of perfectionism in sport, dance and exercise:  
434 Out with the old, in with the 2 x 2. *Current opinion in Psychology*, 16, 72-77.  
435 <http://dx.doi.org/10.1016/j.copsyc.2017.04.021>
- 436 Jackman, P. C., Hawkins, R. M., Burke, S. M., Swann, C., & Crust, L. (2020). The psychology of

- 437 mountaineering: A systematic review. *International Review of Sport and Exercise*  
438 *Psychology*. Advance online publication. <https://doi.org/10.1080/1750984X.2020.1824242>
- 439 Jones, L., Hutchinson, J. C., & Mullin, E. M. (2018). In the zone: An exploration of personal  
440 characteristics underlying affective responses to heavy exercise. *Journal of Sport and*  
441 *Exercise Psychology*, *40*, 249-258. <http://dx.doi.org/10.1123/jsep.2017-0360>
- 442 Joseph, J. E., Liu, X., Jiang, Y., Lynam, D., & Kelly, T. H. (2009). Neural correlates of emotional  
443 reactivity in sensation seeking. *Psychological Science*, *20*(2), 215-223.  
444 <https://doi.org/10.1111/j.1467-9280.2009.02283.x>
- 445 Koob, G. F., & Le Moal, M. (1997). Drug abuse: Hedonic homeostatic dysregulation. *Science*,  
446 *278*(5335), 52-58. <http://dx.doi.org/10.1126/science.278.5335.52>
- 447 Laborde, S., Allen, M. S., Katschak, K., Mattonet, K., & Lachner, N. (2020). Trait personality in  
448 sport and exercise psychology: A mapping review and research agenda. *International*  
449 *Journal of Sport and Exercise Psychology*, *18*(6), 701-716.  
450 <http://dx.doi.org/10.1080/1612197X.2019.1570536>
- 451 Marsh, H. W., Lüdtke, O., Trautwein, U., & Morin, A. J. (2009). Classical latent profile analysis  
452 of academic self-concept dimensions: synergy of person- and variable-centered approaches  
453 to theoretical models of self-concept. *Structural Equation Modeling*, *16*, 191-225.  
454 <https://doi.org/10.1080/10705510902751010>
- 455 McEwan, D., Boudreau, P., Curran, T., & Rhodes, R. E. (2019). Personality traits of high-risk  
456 sport participants: A meta-analysis. *Journal of Research in Personality*, *79*, 83-93.  
457 <https://doi.org/10.1016/j.jrp.2019.02.006>
- 458 Muthén, L. K., & Muthén, B. O. (1998-2012). *Mplus user's guide* (7<sup>th</sup> ed.). Muthén & Muthén.
- 459 Nunnally, J. C. (1978). *Psychometric testing* (2<sup>nd</sup> ed.). McGraw-Hill.
- 460 Roberti, J. W., Storch, E. A., & Bravata, E. (2003). Further psychometric support for the  
461 Sensation Seeking Scale—Form V. *Journal of Personality Assessment*, *81*(3), 291-292.

- 462 [https://doi.org/10.1207/S15327752JPA8103\\_12](https://doi.org/10.1207/S15327752JPA8103_12)
- 463 Rumbold, J. L., Fletcher, D., & Daniels, K. (2020). An experience sampling study of  
464 organizational stress processes and future playing time in professional sport. *Journal of*  
465 *Sports Sciences*, 38(5), 559-567. <https://doi.org/10.1080/02640414.2020.1717302>
- 466 Russo, P. M., Leone, L., Penolazzi, B., & Natale, V. (2012). Circadian preference and the big five:  
467 The role of impulsivity and sensation seeking. *Chronobiology International*, 29(8), 1121-  
468 1126. <https://doi.org/10.3109/07420528.2012.706768>
- 469 Silvia, P. J., & Christensen, A. P. (2020). Looking up at the curious personality: Individual  
470 differences in curiosity and openness to experience. *Current Opinion in Behavioral*  
471 *Sciences*, 35, 1-6. <https://doi.org/10.1016/j.cobeha.2020.05.013>
- 472 Woodman, T., Hardy, L., & Barlow, M. (2020). High-risk sports. In G. Tenenbaum and Robert C.  
473 Eklund (Eds.) *Handbook of sport psychology* (4<sup>th</sup> ed.), pp. 177-189. Wiley.
- 474 Zheng, Y., Tian, M., Li, Q., & Liu, X. (2019). Greater tolerance to losses in sensation seeking:  
475 Evidence from probability and delay discounting. *Drug and Alcohol Dependence*, 194,  
476 159-165. <https://doi.org/10.1016/j.drugalcdep.2018.09.027>
- 477 Zuckerman, M. (1979). *Sensation seeking: Beyond the optimal level of arousal*. Lawrence  
478 Erlbaum Associates.
- 479 Zuckerman, M. (1983). Sensation seeking and sports. *Personality and Individual Differences*,  
480 4(3), 285-293.
- 481 Zuckerman, M., Eysenck, S. B., & Eysenck, H. J. (1978). Sensation seeking in England and  
482 America: Cross-cultural, age, and sex comparisons. *Journal of Consulting and Clinical*  
483 *Psychology*, 46(1), 139-149. <https://doi.org/10.1037/0022-006X.46.1.139>

Table 1. Descriptive statistics, coefficient alphas, bivariate and biserial correlations of the study variables ( $N = 331$ )

Variable	Mean	SD	1	2	3	4	5	6	7	8	9	10	11
1. Extraversion	3.24	0.72	(.87)										
2. Neuroticism	2.65	0.81	-.34	(.87)									
3. Conscientiousness	3.47	0.64	.25	-.35	(.79)								
4. Agreeableness	3.74	0.50	.14	-.21	.29	(.72)							
5. Openness to new experience	3.82	0.60	.40	<u>-.10</u>	<u>.07</u>	.13	(.75)						
6. Thrill and adventure seeking	7.48	1.89	.20	-.15	<u>-.03</u>	<u>-.03</u>	.11	(.97)					
7. Experience seeking	5.58	1.71	.30	-.14	<u>-.10</u>	<u>.01</u>	.39	.18	(.71)				
8. Disinhibition	4.53	1.66	.21	<u>.02</u>	-.12	.12	<u>.08</u>	.19	.33	(.96)			
9. Boredom susceptibility	2.96	1.75	.20	<u>-.03</u>	-.20	-.37	<u>-.02</u>	.16	.16	.29	(.71)		
10. Total sensation seeking	20.55	4.50	.35	-.12	-.17	-.19	.22	.62	.64	.69	.62	-	
11. Sex	1.49	0.50	<u>.03</u>	.19	<u>.05</u>	.18	<u>.09</u>	-.14	-.12	-.14	-.19	-.27	-

*Note.* Sex was coded as '1' for males and '2' for females. Cronbach's alpha coefficients for each subscale are presented in parentheses. Coefficient values  $>.11 = p < .05$ ; Coefficient values  $>.14 = p < .01$ . Underlined coefficients indicate a non-significant relationship.

Table 2. Table of model fit statistics and profile membership distribution for the big five personality domains

Model	Fit statistics				Profile Membership Distribution				
	BIC	SSABIC	BLRT	Entropy	1	2	3	4	5
One-profile	3306.898	3275.177	N/A	N/A					
Two-profile	3209.666	3158.913	-1624.438***	0.582	145	186			
Three-profile	3216.443	3146.658	-1558.416***	0.572	108	59	164		
Four-profile	3219.219	3130.402	-1544.398***	0.616	62	56	106	107	
Five-profile	3238.219	3130.370	-1528.380 <sup>ns</sup>	0.659	114	55	91	64	7

*Note.*  $N = 331$ . \*\*\* =  $p < .001$ ; <sup>ns</sup> = non-significant,  $p > .10$ .

Table 3. Means and standard errors of the four big five personality latent profiles ( $N = 331$ )

	Class 1 Healthy ( $n = 62$ )		Class 2 Emotionally Unstable ( $n = 56$ )		Class 3 Measured and Compliant ( $n = 106$ )		Class 4 Curious and Impulsive ( $n = 107$ )	
	<i>M</i>	SE	<i>M</i>	SE	<i>M</i>	SE	<i>M</i>	SE
EXT	3.910	0.150	2.452	0.089	3.080	0.145	3.357	0.132
NEU	1.951	0.163	3.498	0.177	2.261	0.126	3.052	0.140
CON	3.892	0.116	3.043	0.118	3.678	0.101	3.210	0.132
AGR	3.968	0.083	3.476	0.072	3.815	0.091	3.659	0.099
OPE	4.253	0.128	3.260	0.126	3.479	0.124	4.160	0.058

*Note.* EXT = Extraversion; NEU = Neuroticism; CON = Conscientiousness; AGR = Agreeableness; OPE = Openness to experience.



Table 4. Description of the four latent class ( $N = 331$ ) differences in sensation seeking subscales

	Class 1 Healthy ( $n = 62$ )		Class 2 Emotionally Unstable ( $n = 56$ )		Class 3 Measured and Compliant ( $n = 106$ )		Class 4 Curious and Impulsive ( $n = 107$ )		Post-hoc comparisons
	<i>M</i>	SE	<i>M</i>	SE	<i>M</i>	SE	<i>M</i>	SE	
Thrill and adventure seeking	7.920	0.236	6.972	0.248	7.399	0.185	7.589	0.180	a
Experience seeking	6.181	0.201	4.512	0.210	5.144	0.157	6.211	0.153	abdef
Disinhibition	4.589	0.206	4.111	0.216	4.215	0.161	4.988	0.157	ef
Boredom susceptibility	3.076	0.218	2.903	0.228	2.621	0.170	3.200	0.166	

*Note.* a = class 1 differs from class 2; b = class 1 differs from class 3; c = class 1 differs from class 4; d = class 2 differs from class 3; e = class 2 differs from class 4; f = class 3 differs from class 4. Standard errors and post-hoc comparisons are based on 95% bias-corrected bootstrapped estimates.

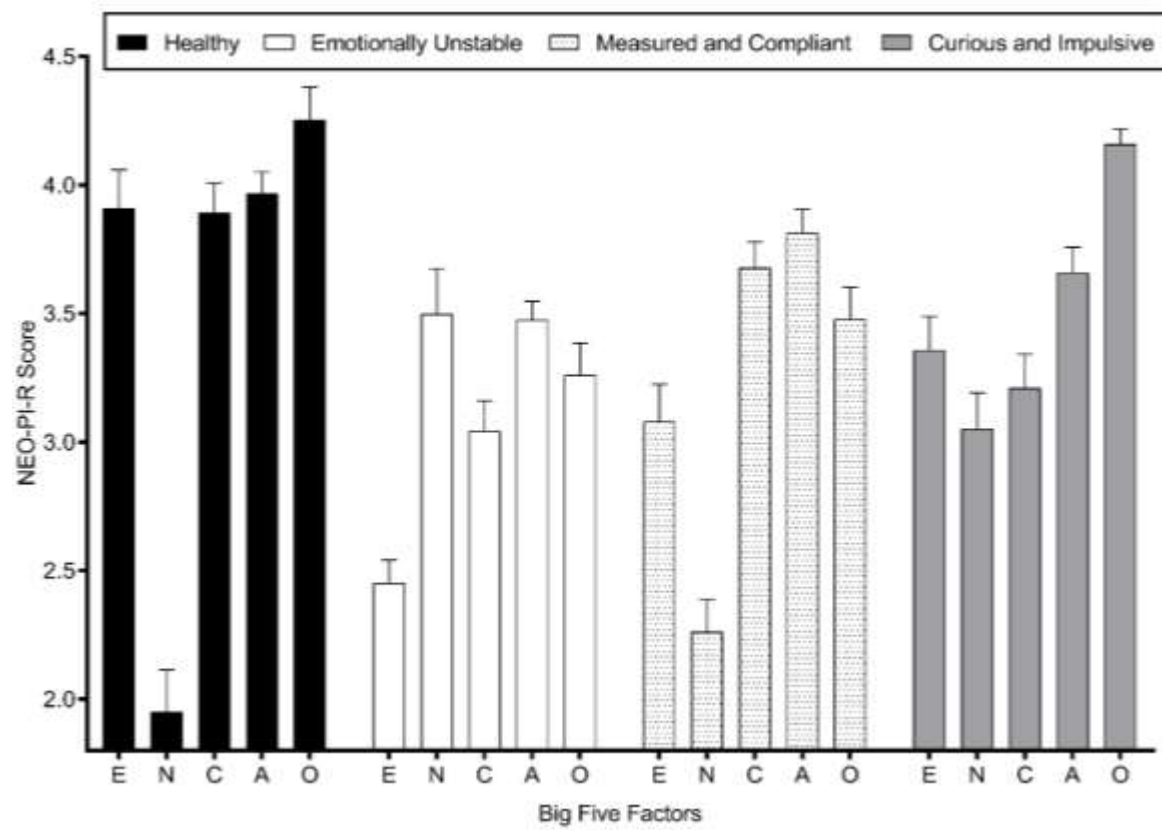


Figure 1. The four personality profiles by Big Five factors. Note. E = Extraversion, N = Neuroticism, C = Conscientiousness, A = Agreeableness, O = Openness to experience.