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Validation Française de l'Échelle d'Aggressivité et de Colère Compétitive (VFEACC)

French Validation of the Competitive Aggressiveness and Anger Scale (FVCAAS)

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1 **ABSTRACT**

2 The aim of this study was to propose a French Validation of the Competitive
3 Aggressiveness and Anger Scale (FVCAAS). The instrument was developed from the
4 original version, which is composed of two subscales (six items by subscales) assessing
5 aggressiveness and anger in competitive athletes (CAAS, Maxwell & Moores, 2007). Four
6 studies have been conducted with 1,428 competitors. In the first study, the exploratory factor
7 analysis extracted the two-factor structure from the original version, both with good internal
8 consistency. The second study confirmed that the two-factor structure of the instrument was
9 consistent with the original version and showed its partial invariance across genders. The
10 third study demonstrated the temporal stability of the FVCAAS. In the fourth study, both
11 concurrent and discriminant validities were confirmed, supporting the validity and reliability
12 of the FVCAAS. The contributions of this study and limitations are discussed, together with
13 perspectives for future studies of aggressiveness in competitive sports.

14

15 *Keywords:* Aggressiveness, Validation, Competitive Aggressiveness and Anger Scale,
16 Structural equation modeling, Gender invariance.

17 **RÉSUMÉ**

18 L'objet de cette étude est de valider une version française de l'échelle d'agressivité et
19 de colère compétitive (VFEACC) parce qu'elle met l'accent sur les antécédents les plus
20 importants de l'agression chez l'athlète. L'outil a été développé à partir de la version originale
21 qui est composée de deux sous-échelles de six items mesurant l'agressivité et la colère des
22 compétiteurs (CAAS, Maxwell & Moores, 2007). Quatre études ont été réalisées auprès de
23 1428 compétiteurs. Dans la première étude, l'analyse factorielle exploratoire reproduit le
24 même modèle à deux facteurs de la version originale, avec de bonnes consistances internes
25 [Colère: $\alpha = .87$; Agressivité: $\alpha = .84$; Échelle totale: $\alpha = .81$]. La deuxième étude a confirmé
26 la même structure à deux facteurs de la version originale avec de bonnes indices d'ajustement
27 [$X^2(53) = 100,77$; CFI et TLI $\geq .95$; RMSEA et SRMR $\leq .06$]. Aussi, elle soutient
28 l'invariance partielle au niveau le plus contraint (i.e., strict) de la structure factorielle de la
29 VFEACC à travers le genre et montre que cet instrument est valide pour les garçons et les
30 filles. La troisième étude a montré la stabilité temporelle de la VFEACC. Les tests *t* se sont
31 avérés non significatifs, ainsi les scores de corrélation, de consistance et de fiabilité étaient
32 significatifs [$r \geq .60$; $\alpha \geq .69$; ICC $\geq .60$, $p < .05$]. Enfin, la quatrième étude a montré la
33 validité concurrente de l'instrument au travers de ses relations avec d'autres construits
34 mesurant l'agressivité et la colère (Masse, 2001) et le désengagement moral en sport (Corrion
35 *et al.*, 2010), aussi la validité discriminante a été vérifiée par les scores de comparaison selon
36 le sexe d'athlète (garçons *vs* filles) et le type du sport (contact *vs* sans-contact). Ces résultats
37 supportent la validité, la fiabilité et l'utilité de l'VFEACC pour mesurer l'agressivité et la
38 colère compétitive chez les athlètes français. L'apport de cette étude, certaines limitations et
39 des perspectives pour de futures recherches sur l'agressivité et la colère ont été discutées.

40 *Mots clés* : Agressivité, Validation, Échelle d'Aggressivité et de Colère Compétitive,
41 Équation structurelle, Invariance selon le sexe.

42 The current research in applied sport and exercise psychology evidences that the
43 Competitive Aggressiveness and Anger Scale (CAAS; Maxwell & Moores, 2007) has been
44 one of the most efficient self-report inventories for measuring athletes' aggressiveness and
45 anger over the past ten years in studying Chinese and American (Maxell, Moores, & Chowc,
46 2007; Visek, Maxwell, Watson, & Hurst, 2010), Greek (Bebetsos, Christoforidis, & Mantis,
47 2008; Bebetsos, 2018), and Portuguese athletes (Sofia & Cruz, 2012, 2017).

48 The construct validity of the CAAS has been demonstrated among Greek team
49 handball athletes (Bebetsos *et al.*, 2008). The CAAS has also been useful in predicting
50 aggressive behaviors or other outcomes in athletes through the relationship between its two
51 subscales and both past unsanctioned aggression and professionalization in Hong Kong
52 Rugby players (Maxwell & Vasik, 2009), and athletic experience among Greek male and
53 female water-polo athletes (Bebetsos, 2018). Likewise, Sofia and Cruz (2017) confirmed the
54 relationship between two subscales of the CAAS and anti-social behavior, provocation,
55 aggressive behavior toward opponents and teammates, anger rumination, and state/trait anger
56 expression in a sample of Portuguese athletes involved in sports with various contact levels
57 (i.e., roller hockey, rugby, volleyball, basketball, kickboxing, and Greco-Roman wrestling).

58 Little is known, however, about the propensity for aggressiveness and anger among
59 French athletes compared with the other athletes. This dearth of research is partly due to the
60 lack of standard measurement tools that are linguistically, metrically, and conceptually
61 equivalent for this sample of athletes. Thus, the research presented here describes the
62 development of a French version of the CAAS (Maxwell & Moores, 2007).

63 A number of sports psychologists have noted that competitive, organized sport is
64 conducive to unethical and aggressive behavior, particularly if such behavior is positively
65 reinforced (Conroy, Silva, Newcomer, Walker, & Johnson, 2001) or a win-at-all-costs
66 philosophy prevails (Keeler, 2007; Nucci & Kim, 2005). Researchers have shown that

67 athletes' aggression is related to a variety of contextual and personal factors, including the
68 type of sport (Maxwell, Visek, & Moores, 2009; Mutz, 2012), training methods (Nosanchuk
69 & MacNeil, 1989), level of competition (Maxwell *et al.*, 2009), sex (Coulomb-Cabagno &
70 Rascale, 2005), moral disengagement (Boardley & Kavussanu, 2007; d'Arripe-Longueville,
71 Corrion, Scoffier, Roussel, & Chalabaev, 2010; Stanger, Kavussanu, Boardley, & Ring,
72 2013), performance in contact sports (McCarty & Kelly, 1978; Sheldon & Aimar, 2001), and
73 goal orientation (Rasclé, Coulomb, & Pfister, 1998; Dunn & Dunn, 1999).

74 Over the past 15 years, theories of aggression have emerged from a wide range of social
75 and psychological perspectives (see Bredemeier, 1985; Kimble, Russo, Bergman, & Galindo,
76 2010; Maxwell, 2004; Russell, 2008). A number of quantitative studies have used self-report
77 measures to examine aggression, particularly to predict aggression in on-field athletes
78 (Kimble *et al.*, 2010). Several instruments are widely used by sport psychologists to study
79 aggression: (a) the Buss-Durkee Hostility Inventory (BDHI; Buss & Durkee, 1957); (b) Buss-
80 Perry Aggression Questionnaire (BPAQ, an updated version of the Buss-Durkee Hostility
81 Inventory; Buss & Perry, 1992); (c) the Bredemeier Athlete Aggression Inventory (BAAGI;
82 Bredemeier, 1975); (d) the Continuum of Injurious Acts (CIA) and its variants (Bredemeier,
83 1985); and (e) the Sports Behavior Inventory (Conroy *et al.*, 2001).

84 Despite their popularity and the fact they have been widely used in the
85 study of aggression, a number of studies have revealed some psychometric problems that may
86 call into question the reliability and the validity of these instruments (Teubel, Asendorpf, &
87 Banse, 2011; Maxwell, 2007; Bryant & Smith, 2001; Hennessy & Wiesenthal, 2001;
88 Stephens, 1998;. Wall & Gruber, 1986). At first, some studies reported that the structural
89 models based on Buss and Perry's (1992) original four-factor (29-item) scale failed to
90 replicate in three independent American (Bryant & Smith, 2001) and the Chinese samples
91 (Maxwell, 2007), and achieved only mediocre goodness-of-fit (i.e., GFI= .76 - .81). Some of

92 the scale's items did not reflect the direct endorsement of aggressive traits, had low or
93 multiple loadings, and reverse-scored (Bryant & Smith, 2001). Additionally, in the sport
94 context, the German version of Buss and Perry's (1992) four-factor (27-item) scale failed to
95 predict both aggressive behavior in players (i.e., fouls in ten minutes), and other outcomes
96 such as scoring in ten minutes, and coach's judgment on game performance in semi-
97 professional basketball (Teubel *et al.*, 2011). The authors indicated that the poor validity of
98 this measure was one of the reasons for their results and confirmed the previous critiques.
99 They noted that, "At the first, standard aggressiveness measures could be criticized for their
100 poor validity in sport context (Maxwell & Moores, 2007)" (Teubel *et al.*, 2011, p. 397). In
101 addition, the BAAGI (Bredemeier, 1975) is criticized for two main reasons: (1) analysis of
102 the internal consistency revealed somewhat poor values for the instrumental subscale (Wall &
103 Gruber, 1986), and (2) its items failed to account for differences across sports aggression
104 (Stephens, 1998; Hennessy & Wiesenthal, 2001).

105 In fact, Maxwell and Moores (2007) made three important criticisms of these
106 questionnaires, arguing that they (a) lacked validity, (b) were not sensitive to sport-specific
107 confrontations, and (c) captured moods rather than traits. They indicated that "application of
108 the Buss-Durkee and Buss-Perry scales is problematic in sport because some of the items
109 refer to acts that are integral to performance in some sports and other items are not
110 applicable" (Maxwell & Moores, 2007, p. 181). They also noted that aggression in athletes
111 has been linked to anger arising, which is linked to increased arousal during the competition
112 and acceptance of aggression; yet none of the existing questionnaires directly measured these
113 factors of arousal arising and acceptance of aggression in sport. To overcome these problems,
114 Maxwell and Moores (2007) suggested focusing on the most important antecedents of the
115 aggression: anger and aggressiveness. Aggressiveness is defined as the "acceptance of and
116 willingness to use abuse, both physical and verbal, to gain a competitive advantage"

117 (Maxwell & Moores, 2007, p. 185), and “anger can be triggered by a multitude of events that
118 may occur externally (e.g., threatening language from an opponent or poor officiating) or
119 internally (e.g., negative self-talk related to poor performance and memories of past defeat)”
120 (Maxwell *et al.*, 2009, p. 289).

121 As a result, Maxwell and Moores (2007) developed the Competitive Anger and
122 Aggression Scale (CAAS) on this basis to measure different antecedents of aggression in
123 sport (i.e., the disposition to become aggressive, acceptance of and willingness to use
124 aggression, incidents of irritation associated with losing, and negative emotions directed at
125 opponents). In their study, the CAAS was developed through several phases. It began with
126 constructing a pool of potential items rated on five-point Likert scales ranging from “not at
127 all severe” (1) to “extremely severe” (5). Next, an Exploratory Factor Analysis (EFA) was
128 used to evaluate the underlying structure of the items and two factors were extracted: anger
129 and aggressiveness. Six items loaded saliently on each factor, which had a good internal
130 consistency (Anger: $\alpha = .87$; Aggressiveness: $\alpha = .84$; Total: $\alpha = .87$). Subsequently, a
131 Confirmatory Factor Analysis (CFA) revealed that all the parameters had a good fit. The two
132 subscales and the total scale also showed good test-retest reliability. Finally, the concurrent
133 and discriminate validity were also supported, the CAAS score was positively associated with
134 aggression as a personality trait as measured by the BPAQ, and varied across genders and
135 sports. They showed that males scored higher than females on both anger and aggressiveness
136 measures; the intensity of anger was relatively low, compared with aggressiveness, but
137 endorsement by British athletes was higher. These analyses confirmed that the CAAS was a
138 suitable instrument for measuring anger and aggressiveness in competitive sports. Hence, the
139 CAAS, by its psychometrical quality, was tested and encouraged in cross-cultural studies,
140 which showed that the two-factor structure of the 12-item CAAS was largely replicable

141 across cultures (Maxell *et al.*, 2007; Visek *et al.*, 2010; Bebetos *et al.*, 2008; Bebetos, 2018;
142 Sofia & Cruz, 2012, 2017).

143 In conclusion, the evidence to date suggests that the CAAS was developed to measure
144 antecedents of aggression in sport (i.e., the disposition to become aggressive, acceptance of
145 and willingness to use aggression, incidents of irritation associated with losing, and negative
146 emotions directed at opponents), is a valid measure of anger and aggressiveness in many
147 sports, and that these concepts reliably differentiate players who admit unsanctioned
148 aggression from those who do not (e.g., Maxell *et al.*, 2007; Visek *et al.*, 2010; Bebetos *et*
149 *al.*, 2008; Bebetos, 2018; Sofia & Cruz, 2012, 2017). Therefore, the CAAS will be more
150 appropriate in a variety of sports in measuring the traits of aggressiveness and anger than
151 other standard aggressiveness measures that have been criticized for their poor validity in
152 sports (e.g., Maxwell & Moores, 2007; Teubel *et al.*, 2011; Wall & Gruber, 1986; Hennessy
153 & Wiesenthal, 2001).

154 However, according to Maxwell and Moores' critics, it appears that a valid
155 questionnaire for measuring anger and aggressiveness does not actually exist among French
156 competitive athletes. The aim of this study, therefore, was to test a French Validation of the
157 Competitive Aggressiveness and Anger Scale (FVCAAS) based on the original CAAS,
158 using a large sample of French competitive athletes.

159 In accordance with Vallerand's (1989) recommendations, the FVCAAS was
160 developed through four studies: (a) development of a preliminary version of the FVCAAS
161 (Study 1); (b) confirmation of the factor structure of the FVCAAS and testing its gender
162 invariance (Study 2); (c) evaluation of the temporal stability of the instrument (Study 3); and
163 (d) assessment of its concurrent and discriminant validity (Study 4).

164 **1. Study 1**

165 The aims of the first study were (a) developing items for a preliminary FVCAAS, (b)
166 verifying the clarity of items using a sample of French athletes, and (c) assessing its structure
167 using EFA.

168 *1.1. Method*

169 *1.1.1. Participants and procedure*

170 Sample 1a consisted of 30 athletes (15 men; 15 women; $M_{age} = 15.66$ years; $SD =$
171 1.47 ; range: 14-18) who were randomly selected from various individual and team sports;
172 the sample was used to assess the clarity of the items of the FVCAAS. Sample 1b
173 consisted of 201 volunteer athletes (109 males; 92 females; $M_{age} = 19.61$; $SD = 4.95$; range:
174 14-25) in a range of sports (e.g., handball, football, basketball, and judo). These athletes
175 provided data for the EFA. They completed the initial FVCAAS at their clubs. Athletes
176 under 18 were enrolled if they agreed to participate and their parents provided written consent
177 for their participation, in line with ethical standards. Participation was voluntary and
178 anonymous and participants were assured that their data would remain strictly confidential.

179 *1.2. Results and Discussion*

180 *1.2.1. Formulation of items*

181 First, in accordance with Vallerand's (1989) and Brislin's (1986) back-translation
182 procedures, the CAAS was translated into French. Two independent translations into French,
183 led by two English-language experts, were undertaken to establish the best expression of each
184 item, and a French version was created thereafter. The French version was then translated
185 back into English by a perfectly bilingual speaker. The French version was established based
186 on this process of translating and adapting the instruments. The original CAAS and the
187 French version FVCAAS were equivalent (Table 1). Responses to the FVCAAS items were

188 made on a five-point Likert scale (1 = almost never; 2 = occasionally; 3 = sometimes; 4 =
189 quite often; 5 = almost always).

190 1.2.2. Assessment of item clarity

191 In the second phase, the clarity of the 12-item FVCAAS was measured using a six-
192 point Likert scale ranging from 1 (“not at all clear”) to 6 (“completely clear”). Sample 1a was
193 asked to respond as honestly as possible to the questions and assured that their responses
194 would be anonymous. The results showed that the items had satisfactory clarity ($M = 4.88$,
195 $SD = 1.12$) and in one-to-one interviews all the participants declared that the items were easy
196 to understand and represented their behaviors.

197 1.2.3. Exploratory factor analysis

198 In the third phase, responses to the FVCAAS were analyzed using SPSS12.0 software.
199 Principal component analysis followed by Oblimin rotation with Kaiser normalization
200 revealed two six-item factors that together accounted for 45.90% of the variance in scores.
201 The two factors were named “Anger” and “Aggressiveness,” and their initial Eigen values
202 were 4.14 and 1.36, respectively; they accounted for 34.45 % and 11.38% of variance in
203 scores, respectively. Also, factor loadings generally were good to high (Table 1).

204 Table 1 also shows that in descriptive terms the mean Anger score ($M = 2.64$, $SD =$
205 1.23) was higher than the mean Aggressiveness score ($M = 1.94$, $SD = 1.23$). Our results are
206 in accord with Maxwell *et al.*'s (2009) study on Hong Kong Chinese athletes, which showed
207 that the intensity of anger was relatively high, compared with the aggressiveness in different
208 contact sports (i.e., basketball, rugby union, association football/soccer, and squash). Our
209 results, however, did not support the early findings in British athletes (Maxwell & Moores,
210 2007). Our findings suggest that the expression of Anger may be more frequent than
211 Aggressiveness among French athletes. Our results also support the idea that intense anger
212 and irritation, which are generated by losing frequently or a referee's mistakes, may be

213 reflected as an ineffective reaction directed at opponents or officials in French contact sports,
214 such as soccer (Maxwell *et al.*, 2009; Reynes, Canovas, Ferrand, & Pantaleon, 2008).

215 All items had acceptably low skewness and kurtosis ($< \pm 1.98$), and the distribution of
216 data did not deviate significantly from normality. Both subscales and the scale as a whole
217 showed good internal consistency, as measured by Cronbach's alpha (Anger: $\alpha = .71$;
218 Aggressiveness: $\alpha = .76$; Total: $\alpha = .82$).

219 **“(Insert Table I here)”**

220 **2. Study 2**

221 The second study aimed to assess (a) the factor structure of the FVCAAS using CFA
222 and (b) the gender invariance of the instrument according to previously described procedures
223 (Chen, 2007; Cheung & Rensvold, 2002; Keith, 2015).

224 *2.1. Method*

225 *2.1.1. Participants and procedure*

226 Two new samples of volunteer athletes who were competing regularly were recruited
227 from various clubs. Sample 2a consisted of 252 athletes (141 male; 111 females; $M_{age} =$
228 18.84 ; $SD = 3.99$) and provided data for the first CFA. Sample 2b consisted of 619 athletes
229 (310 males; 309 females; $M_{age} = 16.97$; $SD = 2.96$) and provided data for the second CFA
230 and the invariance test. The athletes completed the FVCAAS using a five-point scale,
231 ranging from 1 (“almost never”) to 5 (“almost always”).

232 *2.1.2. Data analysis*

233 CFAs were conducted using IBM SPSS AMOS 24 software (Arbuckle, 2016) to
234 confirm the factor structure of our scale in a new sample (Sample 2a). The appropriateness of
235 the model must assess with global goodness-of-fit indices to the data. The fit of the model
236 was assessed using five indices, with the criteria for acceptable fit (Hu & Bentler, 1999)

237 given in the following parentheticals: chi-squared (χ^2); root mean square error of
238 approximation (RMSEA; $\leq .08$ at 90% CI); comparative fit index (CFI; $\geq .90$); the Tucker-
239 Lewis index (TLI; $\geq .90$); and standardized root mean square residual (SRMR; $\leq .08$).

240 The gender invariance of the FVCAAS was computed using procedures described
241 previously (Chen, 2007; Cheung & Rensvold, 2002; Keith, 2015). Two perspectives were
242 used: (a) the traditional perspective based on change on chi-squared ($\Delta\chi^2$), and (b) the
243 practical perspective based on differences in the comparative fit index (Δ CFI). The $\Delta\chi^2$ test
244 allows one to compare nested models (e.g., configural vs. metric; metric vs. strong; and
245 strong vs. strict), but due to its sensitivity to model complexity and large samples, it is nearly
246 always large and statistically significant (Chen, 2007). Cheung and Rensvold (2002)
247 recommended Δ CFI over $\Delta\chi^2$ based on its relative insensitivity to model complexity, sample
248 size, and overall fit. They stated, “A value of Δ CFI smaller than or equal to -.01 indicates that
249 the null hypothesis of invariance should not be rejected” (Cheung & Rensvold, 2002, p. 251).
250 In this study, in deciding whether the fit of more restrictive models was gender invariant we
251 used Chen’s (2007) criteria for invariance between nested models given a sample of >300 :
252 Δ CFI $\leq .01$; Δ RMSEA $\leq .015$ and Δ SRMR $\leq .03$ for metric invariance; and Δ CFI $\leq .01$,
253 Δ RMSEA $\leq .015$ and Δ SRMR $\leq .01$ for the more complex models.

254 2.2. Results and Discussion

255 2.2.1. Confirmatory factor analysis

256 To verify the two-factor structure suggested by EFA, we carried out CFA with a new
257 sample. Figure 1 shows that the factor loadings were fair to high (.58-.78 for Sample 2a) and
258 the CFA results provided good fit indices [CFI and TLI $\geq .93$, RMSEA $\leq .08$, and SRMR \leq
259 .05] and confirmed that the 12-item FVCAAS has a two-factor structure (Table 2). These
260 results confirmed that the FVCAAS was similar to the original CAAS scale (Maxwell &
261 Moores, 2007).

262 “(Insert Figure 1 here)”

263 2.2.2. Gender invariance

264 Table 2 reveals that the model fits each data group well, suggesting that the following
265 invariance verification was meaningful. Also, it reveals that the configural invariance model
266 was accepted, based on the global fit indices. There was a significant χ^2 value and good fit
267 indices [CFI and TLI \geq .92, RMSEA = .05, and SRMR = .06], which makes it possible to
268 envisage the metric invariance. Next, the metric invariance model was practically supported
269 by the data. The addition of test loading factors reduced the fit according to $\Delta\chi^2$ [i.e., $\Delta\chi^2$
270 = 37,58, $\Delta p < .01$], due to its sensitivity to complex models and large samples, but not
271 according to Δ CFI, Δ RMSEA, and Δ SRMR. The change value for these measures was \leq .01,
272 which is equal to or well below the recommended criteria (Chen, 2007; Cheung & Rensvold,
273 2002), which revealed that the FVCAAS two-factor structure between men and women
274 should be similar. However, we rejected full, strong invariance. The differences in the χ^2 and
275 CFI between the strong and the metric invariance models were very large and beyond the
276 recommended criteria [i.e., $\Delta\chi^2 = 79,97$, $\Delta p < .01$, Δ CFI = .03]. Next, we tested for partial
277 strong invariance. The modification indices put forward by the AMOS program suggested
278 unconstraining the error of measurement for item agg1 (Violent behavior directed towards an
279 opponent is acceptable) and item agg2 (It is acceptable to use illegal physical force to gain an
280 advantage) in both groups, which the analysis showed satisfactory partial strong invariance
281 according to changes in CFI and other fit indices [Δ CFI = .01, Δ RMSEA, and Δ SRMR = 0].
282 Finally, partial strict invariance was also supported by data [Δ CFI = .01, Δ RMSEA = 0, and
283 Δ SRMR = -.01], implying that the test intercepts and test residuals were the same in both
284 male and female groups (Chen, 2007; Cheung & Rensvold, 2002), with the exception of two
285 items (agg1 and agg2). Therefore, an adaptation to improve the invariance in these items
286 according to gender should be considered in future studies. In sum, this series of sample

287 analyses indicated partial invariance at the most complex (i.e., strict) levels of the FVCAAS
288 factorial structure across genders.

289 “(Insert Table II here)”

290 3. Study 3

291 The aim of this study was to check the temporal stability and internal consistency of
292 the FVCAAS.

293 3.1. Method

294 3.1.1. Participants and procedure

295 The new sample (Sample 3) consisted of 61 volunteer athletes (42 males, 19 females;
296 $M_{age} = 18.47$; $SD = 4.91$) who undertook regular physical activity. They completed the
297 FVCAAS twice (T1 and T2) in a four-week period as interval between two tests.

298 3.2. Results and Discussion

299 The intraclass correlation coefficient (ICC) and 95% CI for the ICC, together with a
300 series of paired-sample *t*-tests, were used to assess the temporal stability of the
301 questionnaire’s structure. The ICCs and the ICC 95% CIs for both subscales are provided in
302 Table 3. The ICCs were statistically significant in all cases. The ICCs for Anger,
303 Aggressiveness, and the FVCAAS as a whole were .71, .71, and .79, respectively at T1. The
304 corresponding values at T2 were .72, .60, and .66. These results indicate that both subscales
305 and the FVCAAS had acceptable temporal stability. The results of *t*-tests comparing subscale
306 scores at T1 and T2 were non-significant, indicating that FVCAAS responses remained
307 similar over a four-week period. In addition, significant positive correlations were found
308 between the first and second collections of data for each subscale (Anger: $r = .63$;
309 Aggressiveness: $r = .60$; Total: $r = .62$; all $ps < .05$). These findings show that the FVCAAS
310 and its subscales had good temporal stability over four weeks. Finally, the internal

311 consistency of the subscales was assessed at T1 and T2; once again the Cronbach's α were
312 acceptable (T1: $\alpha = .72-.79$; T2: $\alpha = .69-.71$).

313 **“(Insert Table III here)”**

314 **4. Study 4**

315 Study 4 had two aims. First, to assess the concurrent validity of the FVCAAS by
316 calculating correlations between FVCAAS scores and scores on two other instruments
317 measuring constructs that are theoretically related to those measured by the CAAS (Maxwell
318 & Moores, 2007). The second aim was to check its discriminant validity.

319 In accordance with Maxwell and Moores's (2007) research, the concurrent validity
320 was assessed by comparing subscale and total scores on the FVCAAS with (a) subscale and
321 total scores on the French version of BPAQ (Masse, 2001), which measures four components
322 of trait aggression (physical aggression, verbal aggression, anger, and hostility) and (b) an
323 index of moral disengagement, which has been defined as “the self-regulatory process by
324 which individuals cognitively restructure their inhumane conduct, the negative effects of their
325 actions, their role in causing harm, or the targets of their transgressive acts” (d'Arripe-
326 Longueville *et al.*, 2010, p.598). Researchers (e.g., Boardley & Kavussanu, 2007; d'Arripe-
327 Longueville *et al.*, 2010; Stanger *et al.*, 2013) have demonstrated: (a) strong positive
328 associations between sport-related moral disengagement and both negative affect (e.g.,
329 irritability) and antisocial or transgressive behavior (i.e., behavior intended to harm or
330 disadvantage other athletes; the intention to cheat) and (b) moderate negative correlations
331 between sport-related moral disengagement and prosocial behavior (i.e., behavior intended to
332 help or benefit other athletes).

333 Next, to check the discriminant validity of the FVCAAS, we used a multivariate
334 analysis of variance (MANOVA) to examine how FVCAAS subscale scores varied across
335 genders and sports. Maxwell and Moores (2007) suggested that scores on the Competitive

336 Aggressiveness and Anger subscales of the CAAS varied across genders and sports. They
337 reported that male athletes tended to be more aggressive in sports than female athletes, and
338 that aggressive athletes were drawn to contact sports over non-contact sports.

339 *4.1. Method*

340 *4.1.1. Participants and procedure*

341 A new sample (Sample 4) of 175 volunteer athletes (106 males; 69 females; $M_{age} =$
342 19.59 ; $SD = 5.34$; range: 12-35) who were involved in high-contact (rugby: $n = 83$) or low-
343 contact (basketball: $n = 92$) sports (see Table 5). This sample was recruited to verify the
344 concurrent and discriminant validity of FVCAAS. The athletes completed four questionnaires
345 to enable us to assess the correlations between the FVCAAS and (a) a French version of the
346 BPAQ and (b) an index of moral disengagement. All participants were treated with APA
347 ethical guidelines.

348 *4.1.2. Instruments*

349 *4.1.2.1. French Validation of the Competitive Anger and Aggressiveness Scale*

350 The 12-item FVCAAS developed for this research was used. In Sample 4 the 12-item
351 model was a good fit for the data, $\chi^2(53) = 118.48$; $p < .01$; CFI = .90; TLI = .90; RMSEA =
352 .07; 95% CI RMSEA: .06-.10; SRMR = .06. Values of Cronbach's alpha were good (Anger: α
353 = .78; Aggressiveness: $\alpha = .81$; Total: $\alpha = .86$).

354 *4.1.2.2. Buss-Perry's Aggression Questionnaire*

355 The validated French version of the BPAQ (Masse, 2001) has been used to assess the
356 various aspects of aggression in athletes. It consists of 20 items distributed unequally across
357 four subscales; namely, physical aggression, verbal aggression, anger, and hostility. The
358 physical aggression subscale measures one's tendency to be physically aggressive toward
359 other people or objects (sample item: "If I have to resort to violence to protect my rights, I
360 will"). The verbal aggression subscale measures verbal expression of aggression (sample

361 item: “When people annoy me I tell them what I think of them”). The anger subscale
362 measures the respondent’s feelings of anger (sample item: “I sometimes feel like gunpowder
363 ready to explode”). The hostility subscale assesses hatred of others and of life (sample item:
364 “When people are especially nice to me, I wonder what they want”). Responses are given
365 using a five-point Likert scale ranging from “Extremely uncharacteristic of me” (1) to
366 “Extremely characteristic of me” (5). In this study the subscales had good internal
367 consistency (α : .75-.90; see Table 4).

368 4.1.2.3. French Short Moral Disengagement Scale

369 Moral disengagement was assessed with the French Short Moral Disengagement
370 Scale (Corrion, Scoffier, Gernigon, Cury, & d’Arripe-Longueville, 2010). The scale consists
371 of three items measuring minimization of transgressions and their consequences (e.g., “It’s
372 not serious if I behave badly [cheating or aggression] if it’s in order to win”) and three items
373 measuring projection of fault onto others (e.g., “It’s not my fault if I behave badly [cheating
374 or aggression] if my opponent started it”). Responses are given on a six-point Likert scale
375 ranging from 1 (“Do not agree at all”) to 6 (“Completely agree”). The reliability of the scale
376 as a whole is $\alpha = .88$.

377 4. 2. Results and Discussion

378 4. 2.1. Concurrent validity of the FVCAAS

379 Correlations were used to evaluate the relationships between subscale and total scores
380 on the FVCAAS and (a) subscale (physical aggression, verbal aggression, anger, and
381 hostility) and total scores on the French BPAQ, and (b) moral disengagement. Pearson
382 correlations indicated FVCAAS-aggressiveness, FVCAAS-anger and FVCAAS-total were
383 systematically correlated with BPAQ-physical aggression, BPAQ-verbal aggression, BPAQ-
384 anger, BPAQ-hostility, and BPAQ-total (r : .39-.57, all $ps < .05$; see Table 4). These findings
385 are consistent with the literature (e.g., Maxwell & Moores, 2007).

386 The concurrent validity of the FVCAAS was also demonstrated by the existence of
387 the expected correlations between FVCAAS-aggressiveness, FVCAAS-anger, and FVCAAS-
388 total and moral disengagement ($r: .42-.55$, all $ps < .05$; see Table 4). These findings are in line
389 with the other research demonstrating strong positive associations between moral
390 disengagement and both antisocial and aggressive behaviors in sport (e.g., Boardley &
391 Kavussanu, 2007; d'Arripe-Longueville *et al.*, 2010). As the FVCAAS was shown to be
392 related to both the established constructs with which it was compared, we concluded that the
393 instrument had concurrent validity.

394 **“(Insert Table IV here)”**

395 4. 2.2. Discriminant validity of the FVCAAS

396 To determine how FVCAAS scores varied across genders and sports, we carried out a
397 2x2 between-subject MANOVA, with gender and types of sport as the independent variables
398 and FVCAAS-aggressiveness, FVCAAS-anger, and FVCAAS-total as the dependent
399 variables. Gender affected the results [Wilks's $\lambda = .88$, $F(2, 170) = 11.22$, $p < .001$, $\eta^2 = .12$]
400 as did the type of sport [Wilks's $\lambda = .85$, $F(2, 170) = 5.33$, $p < .01$, $\eta^2 = .06$], but there was no
401 interaction between gender and type of sport [Wilks's $\lambda = .96$, $F(2, 170) = 0.73$, $p = .69$, $\eta^2 =$
402 $.004$]. Separate univariate ANOVAs were conducted to analyze group differences in each
403 dependent variable. There were gender differences in FVCAAS-aggressiveness [$F(1, 171)$
404 $= 22.56$, $p < .001$, $\eta^2 = .16$], FVCAAS-anger [$F(1, 171) = 6.82$, $p < .01$, $\eta^2 = .04$] and
405 FVCAAS-total [$F(1, 171) = 16.75$, $p < .001$, $\eta^2 = .11$]. The type of sport affected FVCAAS-
406 aggressiveness [$F(1, 171) = 6.71$, $p < .05$, $\eta^2 = .09$] but not FVCAAS-total [$F(1, 171)$
407 $= 1.65$, $p = .2519$, $\eta^2 = .01$] and FVCAAS-anger [$F(1, 171) = 0.03$, $p = .86$, $\eta^2 = .01$]. No
408 multivariate outliers were identified and the means are provided in Table 5.

409 As a result, discriminant validity was established based on the athletes' differences. A
410 number of authors have reported that there is a gender difference in the tendency to value

411 aggressiveness and anger in sport (e.g., Maxwell & Moores, 2007; Christoforidis, Kalivas,
412 Matsouka, Bebetsos, & Kambas, 2010; Bebetsos, 2018). This general observation was
413 completely supported by our data. Male athletes had higher FVCAAS-total, FVCAAS-anger,
414 and FVCAAS-aggressiveness scores than female athletes (Maxwell & Moores, 2007). In the
415 present study, male athletes appear to take advantage of their anger more than female
416 athletes. These findings may suggest that male athletes express their anger, though they
417 experience persistent anger and therefore had a greater tendency toward expressing both their
418 anger and aggressiveness compared with female athletes. However, our results are not
419 consistent with the results of previous research showing no statistically significant differences
420 between female and male athletes regarding trait anger and anger expression styles in
421 taekwondo (Lapa, Aksoy, Certel, Çalışkan, Özçelik, & Çelik, 2013) and volleyball (Esfahani,
422 Gheze, & Soflu, 2010). The results of this previous research were somewhat unsurprising
423 given the nature of the psychosocial factors underlying anger, such as frequently losing or a
424 referee's mistakes (Reynes *et al.*, 2008). This also makes sense when taking into account the
425 importance of anger expression for the athlete's performance (e.g., Lapa *et al.*, 2013;
426 Maxwell, 2004; Robazza & Bortoli, 2007), which may play a role in explaining these
427 findings. But these are factors beyond the scope of the current study. Further investigation on
428 possible associations between these factors may be warranted.

429 As expected, there were also differences in FVCAAS-aggressiveness based on type of
430 sport. Athletes involved in high-contact sports had higher FVCAAS-aggressiveness scores
431 than those involved in low-contact sports. This finding is consistent with previous results
432 (Maxwell & Moores, 2007; Maxwell *et al.*, 2009). It may be that contact sports give players
433 more opportunity for legitimate expression of aggression than non-contact sports.

434 **“(Insert Table V here)”**

435 **5. General Discussion**

436 The aim of this research was to develop and test a French Validation of the CAAS.
437 First, the 12 items of the CAAS were translated by two English-language experts into French
438 to create a preliminary list of items for the FVCAAS. The EFA indicated that these 12 items
439 were organized equally into two factors, Anger and Aggressiveness, with satisfactory internal
440 consistency (Study 1). Study 2 provided evidence of the factorial validity of the FVCAAS, its
441 similarity to the original version, and demonstrated its partial invariance across gender at the
442 most complex level (i.e., strict), also *an adaptation to improve the invariance according to*
443 *genre was suggested for two items (agg1 and agg2) in future study.* The temporal stability of
444 the instrument was also confirmed (Study 3). The concurrent validity of the FVCAAS was
445 demonstrated by relationships between its scales and two instruments measuring constructs
446 that are theoretically related to athletes' aggression. Additionally, the discriminant validity of
447 the FVCAAS was demonstrated by the differences in scores associated with genders and
448 sports (Study 4). Together, these analyses provide comprehensive evidence of the validity of
449 the FVCAAS and its ecological validity because the item content was provided by junior and
450 adult competitive athletes.

451 This series of studies carried out with French athletes resulted in the creation of six-
452 item scales measuring competitive anger (sample item: "I become irritable if I am
453 disadvantaged during a match") and competitive aggressiveness (sample item: "Opponents
454 accept a certain degree of abuse"), which are structurally and theoretically valid, reliable,
455 stable over time, and well-suited for testing assumptions about gender differences in anger
456 and aggressiveness. The links between the FVCAAS and different facets of trait aggression
457 and moral disengagement are in line with the existing sport psychology literature, which
458 indicates that competitive anger and aggressiveness are associated with physical and verbal
459 aggression, anger, and hostility (Maxwell & Moores, 2007). It also demonstrates that moral
460 disengagement reduces negative emotional reactions to transgressive behavior and increases

461 one's self-reported likelihood of behaving antisocially in sport (e.g., d'Arripe-Longueville *et*
462 *al.*, 2010; Stanger *et al.*, 2013).

463 Although the FVCAAS demonstrated good psychometric properties in this research,
464 several limitations must be acknowledged. First, all research relying on self-report measures,
465 particularly research concerning moral variables, may be subject to social desirability bias.

466 A second limitation is that the assessment of the scale's construct validity was limited
467 to analysis of its convergent validity and ability to reproduce the gender and type-of-sport-
468 related differences that exist in theoretically related constructs. There is, therefore, a need for
469 further research into the scale's discriminant validity based on comparisons with scales
470 measuring other constructs. The discriminant validity of the instrument would be
471 strengthened by evidence that FVCAAS-anger and FVCAAS-aggressiveness are negatively
472 correlated with theoretically related constructs, such as self-regulatory efficacy in sport
473 (Boardley & Kavussanu, 2007; d'Arripe-Longueville *et al.*, 2010).

474 A third limitation is the specific focus of the FVCAAS. Despite the validity of the
475 FVCAAS for measuring aggressiveness and anger in a variety of sports, some items (e.g.,
476 agg1, agg2, and ang6) that described the acceptability or normativity of aggression and anger
477 expression against the opponent and the referee to gain a competitive advantage are more
478 common and suitable in contact sports (e.g., football/soccer, basketball, rugby, and boxing)
479 than non-contact sports (i.e, climbing, swimining, and gyminstics), which should be
480 acknowledged (e.g., Conroy *et al.*, 2001; Maxwell & Moores, 2007). Therefore, it would be
481 of interest in future studies to undertake more careful scientific investigations to improve the
482 appropriateness of the aggressiveness subscale according to non-contact sport types, or
483 change the format of the original five-point scale from (almost never = 1; occasionally = 2;
484 sometimes = 3; quite often = 4; almost always = 5) to a six-point scale ranging from 1
485 ("extremely uncharacteristic of me") to 6 ("extremely characteristic of me") to eliminate the

486 scale's midpoint and force respondents to decide whether each statement was characteristic of
487 them (Bryant & Smith, 2001).

488 A fourth limitation is that, to date, no predictive validity data are available for this
489 study. The current results of different psychometric tests and their interpretations provide
490 evidence that the FVCAAS is a valid measure of anger and aggressiveness in many sports,
491 and thus there is no coherent argument against its future use with the French athletic
492 population until such data are available to evaluate the test's predictive validity. Therefore,
493 we proposed to continue testing the predictive validity of FVCAAS according to Maxwell
494 and Moores', (2007) and Teubel *et al.*'s (2011) recommendations in future studies, as a
495 second step of validating this scale. The recommendations of Maxwell & Moores (2007) and
496 Teubel *et al.* (2011) indicates the importance of combining both implicit and explicit
497 aggressiveness' questionnaires, interviews, and observations to gain better insight into
498 aggression in sport, rather than relying solely on the subjective interpretation of the athletes.
499 Accordingly, and consistent with prior studies providing the predictive validity of the original
500 CAAS scale (e.g., Bebetos *et al.*, 2008; Maxwell & Vasik, 2009; Sofia & Cruz, 2017;
501 Bebetos, 2018), we hypothesized the existence of a significant positive correlation between
502 FVCAAS scores and frequency of observed aggressive behavior for players in the premier
503 basketball league in France. It will be important to deepen this analysis in future studies.

504 It would also be of interest to compare the levels of anger and aggressiveness between
505 French and British athletes, and to explore whether the cultural differences between France
506 and Great Britain (Hébert & Dugas, 2010) influence their experiences and expressions of
507 anger, as well as the use of aggressive tactics in their behaviors to achieve athletic success.
508 Indeed, many empirical studies have reported that culture was a potential source of difference
509 in aggressiveness between athletes. For example, Hong Kong Chinese athletes reported lower
510 aggressive responses than both British (Maxwell *et al.*, 2007) and American athletes (Visek

511 *et al.*, 2010), although the difference was not observed in anger (Maxwell *et al.*, 2009;
512 Maxwell *et al.*, 2007). The anger reflected frustration provoked by losing points or games and
513 an official's mistakes (Reynes *et al.*, 2008).

514 From a practical standpoint, the FVCAAS could help identify athletes with low or
515 high anger or aggressiveness and determine how these constructs are related to performance
516 among French athletes. Some studies have demonstrated that high aggressiveness and an
517 intermediate level of anger enhance athletic performance, particularly in contact sports (e.g.,
518 McCarty & Kelly, 1978; Robazza, & Bortoli, 2007; Sheldon & Aimar, 2001). Anger may
519 have a positive or negative effect on performance through its effect on arousal; moderate
520 arousal enhances performance but high arousal has a detrimental effect. These findings
521 suggest that aggressiveness and anger are significant aspects of an athlete's profile and
522 should be taken into account to enhance training methods.

523 In conclusion, despite the aforementioned limitations, this series of studies fills a gap
524 in the existing literature and demonstrates that the FVCAAS is a sound, sport-specific
525 instrument for assessing competitive anger and aggressiveness in French athletes.

526 **Conflict of interest 'none'**

527 The authors declare that they have no links of interest.

528 **References**

- 529 Arbuckle, J. L. (2016). *IBM SPSS Amos 24.0. User's guide*. New York: IBM.
- 530 Bebetos, E., Christoforidis, C., & Mantis, K. (2008). Examination of athletes' aggressiveness
531 and anger among Greek team handball athletes. *Exercise & Society, 47*, 80–86.
- 532 Bebetos, E. (2018). How important is the role of national division and experience on water-
533 polo players' levels of anxiety and aggression? *Polish Psychological Bulletin, 49*(3),
534 360–364.
- 535 Boardley, I., & Kavussanu, M. (2007). Development and validation of the Moral
536 Disengagement in Sport Scale. *Journal of Sport & Exercise Psychology, 29*(5), 608–
537 628.
- 538 Bredemeier, B. (1975). The assessment of reactive and instrumental aggression. Dans In
539 Landers, I. D. M. (Ed.), *Psychology of sport and motor behaviour II* (pp. 71–84). State
540 College, PA: Penn State HPER Series.
- 541 Bredemeier, B. (1985). Moral reasoning and the perceived legitimacy of potentially injurious
542 acts. *Journal of Sport & Exercise Psychology, 7*(2), 110–124.
- 543 Brislin, R. W. (1986). The wording and translation of research instruments. Dans In Lonner,
544 W., & Berry, J. (Eds.), *Fields methods in cross-cultural research* (pp. 137–162).
545 Beverly Hills, CA: Sage.
- 546 Bryant, F.B., & Smith, B.D. (2001). Refining the architecture of aggression: A measurement
547 model for the Buss-Perry Aggression Questionnaire. *Journal of Research in*
548 *Personality, 35*(2), 138-167.
- 549 Buss, A. H., & Durkee, A. (1957). An inventory for assessing different kinds of hostility.
550 *Journal of Consulting Psychology, 24*, 349–354.
- 551 Buss, A. H., & Perry, M. (1992). The aggression questionnaire. *Journal of Personality and*
552 *Social Psychology, 63*, 452–459.

553 Chen, F. F. (2007). Sensitivity of goodness of fit indices to lack of measurement invariance.
554 *Structural Equation Modeling, 14*, 464-504.

555 Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing
556 measurement invariance. *Structural Equation Modeling, 9*, 233–255.

557 Christoforidis, C., Kalivas, V., Matsouka, O., Bebetos, E., & Kambas, A. (2010). Does
558 Gender Affect Anger and Aggression in Handball Players? *The Cyprus Journal of*
559 *Sciences, 8*, 3–11.

560 Conroy, D. E., Silva, J. M., Newcomer, R. R., Walker, B. W., & Johnson, M. S. (2001).
561 Personal and participatory socializers of the perceived legitimacy of aggressive
562 behavior in sport. *Aggressive Behavior, 27*, 405–418.

563 Corrion, K., Scoffier, S., Gernigon, C., Cury, F., & d'Arripe-Longueville, F. (2010).
564 Development and factorial validity of a moral disengagement in Sport Short Scale.
565 *L'Encéphale, 36*(6), 495–503.

566 Coulomb-Cabagno, G., & Rasclé, O. (2005). Team sports players' observed aggression as
567 a function of gender, competitive level, and sport type. *Journal of Applied Social*
568 *Psychology, 36*(8), 1980–2000.

569 d'Arripe-Longueville, F., Corrion, K., Scoffier, S., Roussel, P., & Chalabaev, A. (2010).
570 Socio-cognitive self- regulatory mechanisms governing judgments of the acceptability
571 and likelihood of sport cheating. *Journal of Sport and Exercise Psychology, 32*, 595-
572 618.

573 Dunn, J. G. H., & Dunn, J. C. (1999). Goal orientations, perceptions of aggression, and
574 sportpersonship in elite male youth ice hockey players. *Sport Psychologist, 73*, 183–
575 200.

- 576 Esfahani, N., & Gheze Soflu, H. (2010). The Comparison of Pre-Competition Anxiety and
577 State Anger between Female and Male Volleyball Players. *World Journal of Sport*
578 *Sciences*, 3(4), 237–242.
- 579 Hébert, T., & Dugas, E. (2010). France and Great Britain: the perception of aggressiveness in
580 football seen from different angles. *International Review on Sport and Violence*, 94–
581 103.
- 582 Hennessy, D. A., & Wiesenthal, D. L. (2001). Gender, driver aggression and driver violence:
583 An applied evaluation. *Sex Roles*, 44, 661–676.
- 584 Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure
585 analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling:*
586 *A Multidisciplinary Journal*, 6, 1–55.
- 587 Keeler, L. A. (2007). The differences in sport aggression, life aggression, and life assertion
588 among adult male and female collision, contact, and non-contact sport athletes.
589 *Journal of Sport Behavior*, 30(1), 57–76.
- 590 Keith, T. Z. (2015). *Multiple regression and beyond: An introduction to multiple regression*
591 *and structure equation modeling* (2nd edn.). NY: New York: Routledge.
- 592 Kimble, N. B., Russo, S. T., Bergman, B. G., & Galindo, V. H. (2010). Revealing an
593 empirical understanding of aggression and violent behavior in athletics. *Aggression*
594 *and Violent Behavior*, 15, 446– 462.
- 595 Lamarre, B.W., & Nosanchuck, T. A. (1999). Judo-The gentle way: A replication of studies
596 on martial arts and aggression. *Perceptual and Motor Skills*, 88(3), 992-996.
- 597 Lapa, T.Y., Aksoy, D., Certel, Z., Çalışkan, E., Özçelik, M.A., & Çelik, G. (2013). Evaluation
598 of trait anger and anger expression in taekwondo athletes in relation to gender and
599 success. *Procedia - Social and Behavioral Sciences*, 93,1976–1979.

600 McCarty, J. F., & Kelly, B. R. (1978). Aggressive behaviour and its effect on performance
601 over time in ice hockey athletes: An archival study. *International Journal of Sport*
602 *Psychology*, 9, 90–96.

603 Masse, C. (2001). *The aggression questionnaire. Adaptation, validation and implementation*
604 *of the French version Aggression Questionnaire de Buss et Perry*. Thèse de doctorat
605 dissertation. Université Joseph Fourier (Grenoble I).

606 Maxwell, J. P. (2004). Anger rumination: an antecedent of athlete aggression? *Psychology of*
607 *Sport and Exercise*, 5, 279–289.

608 Maxwell, J. P., & Moores, E. (2007). The development of a short scale measuring
609 aggressiveness and anger in competitive athletes. *Psychology of Sport and Exercise*, 8,
610 179–193.

611 Maxwell, J. P., Moores, E., & Chow, C. C. F. (2007). Anger rumination and aggression
612 amongst British and Chinese athletes: a cross cultural comparison. *International*
613 *Journal of Sport and Exercise Psychology*, 5, 9–27.

614 Maxwell, J.P. (2007). Development and preliminary validation of a Chinese version of the
615 Buss-Perry Aggression Questionnaire in a population of Hong Kong Chinese. *Journal*
616 *of personality assessment*, 88(3), 284–294.

617 Maxwell, J., & Visek, J. (2009). Unsanctioned aggression in rugby union: Relationships
618 among aggressiveness, anger, athletic identity, and professionalization. *Aggressive*
619 *Behavior*, 35(3), 237–243.

620 Maxwell, J. P., Visek, A. J., & Moores, E. (2009). Anger and perceived legitimacy of
621 aggression in male Hong Kong Chinese athletes: Effects of type of sport and level of
622 competition. *Psychology of Sport and Exercise*. 10, 289–296.

- 623 Miller, B. W., Roberts, G. C., & Ommundsen, Y. (2004). Effect of motivational climate on
624 sportpersonship among competitive youth male and female football players.
625 *Scandinavian Journal of Medicine and Science in Sports*, 14(3), 193–202.
- 626 Mutz, M. (2012). Athletic participation and the approval and use of violence: A comparison of
627 adolescent males in different sports disciplines. *European Journal for Sport and*
628 *Society*, 9(3), 177–201.
- 629 Nosanchuk, T. A., & MacNeil, M. L. C. (1989). Examination of the effects of traditional and
630 modern martial arts training on aggressiveness. *Aggressive Behavior*, 15, 153-159.
- 631 Nucci, C., & Kim, Y. (2005). Improving socialization through sport: an analytic review of
632 literature on aggression and sportsmanship. *Physical Educator*, 62(3), 123–129.
- 633 Rascale, O., Coulomb, G., & Pfister, R. (1998). Aggression and goal orientations in
634 handball: Influence of institutional sport context. *Perceptual and Motor Skills*, 86,
635 1347–1360.
- 636 Reynes, E., Canovas S, Ferrand, C., & Pantaléon N. (2008). Conséquences émotionnelles des
637 erreurs d’arbitrage chez les footballeurs : étude exploratoire. *Psicologia & Sociedade*,
638 20(1), 5-15.
- 639 Robazza, C., & Bortoli, L. (2007). Perceived impact of anger and anxiety on sporting
640 performance in rugby players. *Psychology of Sport and Exercise*, 8, 875–896.
- 641 Russell, G. W. (2008). *Aggression in the sports world: A social psychological perspective*.
642 New York: Oxford University Press.
- 643 Sheldon, J. P., & Aimar, C. M. (2001). The role aggression plays in successful and
644 unsuccessful ice hockey behaviors. *Research Quarterly for Exercise and Sport*, 72,
645 304–309.
- 646 Sofia, R.M., & Cruz, J. F. (2012). Adaptação e características psicométricas da ”Escala de
647 Agressividade e Raiva Competitiva”: Estudo preliminar com futebolistas portugueses

648 [Adaptation and psychometric characteristics of the “Competitive Aggressiveness and
649 Anger Scale”: Preliminary study with Portuguese soccer athletes]. *Gymnasium -
650 Revista de Educação Física, Desporto e Saúde, 1*, 210–237.

651 Sofia, R.M., & Cruz, J. F. (2017). Unveiling anger and aggression in sports: The effects of
652 type of sport, competitive category and success level. *Journal of Sport Psychology, 26*,
653 21–28.

654 Stanger, N., Kavussanu, M., Boardley, I. D., & Ring, C. (2013). The influence of moral
655 disengagement and negative emotion on antisocial sport behavior. *Sport, Exercise &
656 Performance Psychology, 2*, 117–129.

657 Stephens, D. E. (1998). Aggression. In J. L. Duda (Ed.), *Advances in sport and exercise
658 psychology measurement* (pp.277–292). Morgantown, WV: Fitness Information
659 Technology, Ltd.

660 Teubel, T., Asendorpf, J.B., & Banse, R. (2011). Implicite but not explicite aggressiveness
661 predicts performance outcome in basketball players. *International Journal of Sport
662 Psychology, 42*, 390-400.

663 Vallerand, R. J. (1989). Toward a methodology for transcultural validation of psychological
664 questionnaires: Implications for research in the French language. *Canadian
665 Psychology, 4*, 662–680.

666 Visek, A. J., Maxwell, J. P., Watson, J. C., & Hurst, J. R. (2010). A cross-cultural evaluation
667 of the factorial invariance of the competitive aggressiveness and anger scale. *Journal
668 of Sport Behavior, 33*(2), 218-237.

669 Wall, B. R., & Gruber, J. J. (1986). Relevancy of athletic aggression inventory for use in
670 women’s intercollegiate basketball: A pilot investigation. *International Journal of
671 Sport Psychology, 17*, 23–33.

672 **Table I: Les items de la VFEACC et l'échelle originale (CASS, Maxwell & Moores, 2007)**

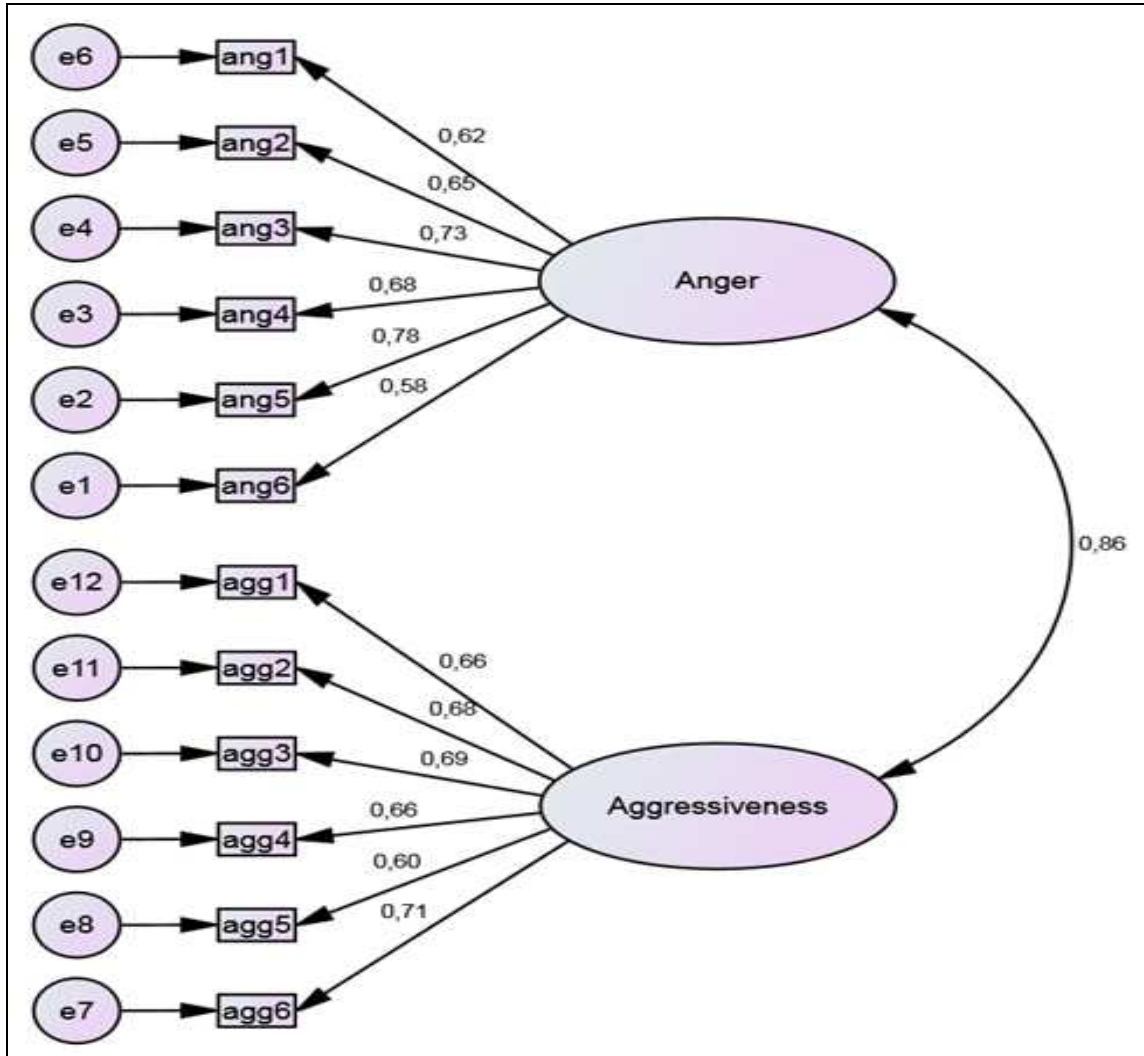
673 **Table I: The items of the FVCAAS and original scale (CASS, Maxwell & Moores, 2007)**

Items assigned to each factor	M	SD	skewness	kurtosis	α	EFA
Anger (F1)	2.64	1.23	-0.70	-0.73	.71	
Ang1. I become irritable if I am disadvantaged during a match. <i>Je deviens irritable si je me sens dépassé(e) lors de ma prestation.</i>	2.83	1.22	-0.42	-0.97		.58
Ang2. I feel bitter towards my opponent if I lose. <i>J'en veux à mes adversaires quand je perds.</i>	2.37	1.25	0.64	-0.52		.64
Ang3. I get mad when I lose points. <i>Je deviens fou/folle quand je perds des points.</i>	2.27	1.26	0.74	-0.53		.69
Ang4. I show my irritation when frustrated during a game. <i>Je montre mon agacement quand je suis frustré(e) pendant ma prestation.</i>	2.36	1.26	0.59	-0.77		.55
Ang5. I find it difficult to control my temper during a match. <i>Je trouve difficile de contrôler ma colère pendant ma prestation.</i>	2.26	1.29	0.73	-0.51		.65
Ang6. Officials' mistakes make me angry. <i>Les erreurs des arbitres me font enrager.</i>	3.08	1.07	-0.13	-1.09		.66
Aggressiveness (F2)	1.94	1.23	0.81	0.72	.76	
Agg1. Violent behavior, directed towards an opponent, is acceptable. <i>Un comportement violent, dirigé contre un adversaire, est acceptable.</i>	1.69	1.07	0.17	0.17		.79
Agg2. It is acceptable to use illegal physical force to gain an advantage. <i>Il est acceptable d'utiliser une force physique non autorisée pour obtenir un avantage.</i>	1.96	1.23	1.28	0.38		.78
Agg3. I taunt my opponents to make them lose concentration. <i>Je provoque mes adversaires pour leur faire perdre leur concentration.</i>	1.89	1.29	1.29	0.16		.63
Agg4. I use excessive force to gain an advantage. <i>J'utilise une force physique excessive pour obtenir un avantage.</i>	2.61	1.33	0.26	-1.19		.60
Agg5. I verbally insult opponents to distract them. <i>J'insulte verbalement mes adversaires pour les distraire.</i>	1.35	0.87	1.74	1.86		.71
Agg6. Opponents accept a certain degree of abuse <i>Les adversaires tolèrent un certain degré de violence.</i>	2.16	1.13	0.17	-0.57		.55

674 *Notes.* α : Cronbach's alpha; EFA: loading in the exploratory factor analysis. Ang: Anger; Agg: Aggressiveness.
675 The items French translations are in italics. For each item the participant had to answer on a five-point Likert-
676 type scale from "almost never" (1) to "almost always" (5), $n = 201$.

677 **Figure 1: Coefficients standardisés d'estimation de la structure de la VFEACC**

678 **Figure 1: Standardized coefficients of estimation of the structure of the FVCAAS**



679

680 *Notes.* The standardized coefficients of estimation are all significant at $p < .001$, $n = 252$.

681 **Table II: Indices d'ajustement des modélisations structurales de la VFEACC.**

682 **Table II: Fit indices for the structural modelings of the FVCAAS.**

Models	χ^2	df	p	CFI	TLI	RMSEA	90% CI	SRMR	ECVI	AIC	Comparison	$\Delta\chi^2$	Δdf	Δp	ΔCFI	$\Delta RMSEA$	$\Delta SRMR$	
Structure (n = 252)																		
All (12 items)	100.77	53	< .01	.96	.95	.06	.04–.07	.05	.69	174.76	–	–	–	–	–	–	–	–
Anger (6 items)	17.26	9	.05	.98	.97	.06	.00–.10	.03	.21	53.25	–	–	–	–	–	–	–	–
Aggressiveness (6 items)	28.01	9	< .01	.96	.93	.08	.05–.13	.04	.25	64.01	–	–	–	–	–	–	–	–
Gender invariance(n = 619)																		
Man (n =310)	190.08	53	< .01	.93	.91	.07	.07–.08	.05	.68	211.73	–	–	–	–	–	–	–	–
Woman (n =309)	137.73	53	< .01	.95	.93	.06	.04–.07	.04	.62	192.68	–	–	–	–	–	–	–	–
Configural (non invariance)	256.42	106	< .01	.94	.92	.05	.04–.06	.05	.65	404.42	–	–	–	–	–	–	–	–
Metric (λ equal)	294.00	118	< .01	.93	.92	.05	.04–.06	.06	.67	418.00	1	37.58	12	< .01	.01	0	0	–.01
Strong (τ equal)	373.97	130	< .01	.90	.90	.05	.04–.06	.06	.79	473.97	2	79.97	12	< .01	.03	0	0	0
Partial strong (tagg1, agg2)	323.44	126	< .01	.92	.92	.05	.04–.06	.05	.69	431.44	2	29.44	8	< .01	.01	0	0	0
Partial strict (δagg1, agg2)	360.26	134	< .01	.92	.91	.05	.04–.06	.06	.73	452.26	3	36.82	8	< .01	.01	0	0	–.01

683 *Notes.* τ : Intercepts; χ^2 : Maximum Likelihood chi-square; df: degrees of freedom; TLI: Tucker-Lewis index; CFI: Comparative Fit Index; RMSEA: Root Mean Square Error of
684 Approximation; 90% CI: Confidence Interval 90% for RMSEA; SRMR: Standardized Root Mean Square Residual; ECVI: Expected Cross-Validation Index; AIC: Akaike's
685 Information Criterion; $\Delta\chi^2$: Difference in χ^2 ; Δdf : Difference in degrees of freedom; ΔCFI : Difference in comparative fit index; $\Delta RMSEA$:
686 Difference in mean square error of approximation; $\Delta SRMR$: Difference in standardized root mean square residual.

687 **Table III: Les corrélations du test-retest (4 semaines) pour les échelles de la VFEACC.**

688 **Table III: Four-week test–retest correlations for the FVCAAS subscales.**

Scales	Temporal stability	<i>M</i>	<i>SD</i>	<i>α</i>	ICC	ICC 95% CI	<i>p</i>
Anger	T1	2.60	0.83	.74	.71	.60–.82	< .01
	T2	2.40	0.80	.71	.68	.54–.79	< .01
Aggressiveness	T1	2.04	0.75	.72	.70	.56–.80	< .01
	T2	1.97	0.60	.69	.60	.55–.62	< .01
Total	T1	2.33	0.66	.79	.76	.56–.84	< .01
	T2	2.18	0.57	.70	.66	.51–.77	< .01

689 *Notes.* *α*: Cronbach’s alpha; ICC: Intraclass Correlation Coefficient; ICC 95% CI: 95% Confidence Interval for
690 the ICC, *n*= 61.

691 **Table IV: Liens de la VFEACC avec l'agression et le désengagement moral.**

692 **Table IV: Relationships between the FVCAAS and aggression and moral disengagement.**

Scales	Anger ($\alpha = .78$)	Aggressiveness ($\alpha = .81$)	Total ($\alpha = .86$)
FR-BPAQ Physical ($\alpha = .75$)	.39*	.51*	.52*
FR-BPAQ Verbal ($\alpha = .80$)	.45*	.47*	.51*
FR-BPAQ Anger ($\alpha = .75$)	.57*	.29*	.50*
FR-BPAQ Hostility ($\alpha = .82$)	.42*	.38*	.45*
FR-BPAQ Total ($\alpha = .90$)	.52*	.46*	.57*
Moral disengagement ($\alpha = .88$)	.42*	.55*	.53*

693 *Notes.* * $p < .05$. FR-BPAQ: French version of Buss and Perry's Aggression Questionnaire, $n = 175$

694 **Table V: Moyennes et écart-types des échelles de la FVCAAS en fonction du group.**

695 **Table V: Means and standard deviations for the FVCAAS scales organized by group.**

Grouping factor	Group	Anger			Aggressiveness		Total	
		<i>N</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
All		175	2.45	0.81	1.95	0.80	2.20	0.71
Gender	Males	106	2.58*	0.82	2.21*	0.81	2.93*	0.72
	Females	69	2.25	0.75	1.55	0.59	1.90	0.59
Sport	High-Contact	83	2.51	0.84	2.20*	0.89	2.35	0.77
	Low-contact	92	2.40	0.78	1.71	0.63	2.06	0.63
Gender x Sport	Males x High-Contact	63	2.61	0.76	2.36	0.85	2.48	0.27
	Females x High-Contact	20	2.15	0.98	1.73	0.84	1.94	0.79
Gender x Sport	Males x Low-contact	44	2.52	0.90	1.99	0.71	2.25	0.71
	Females x Low-contact	49	2.29	0.64	1.47	0.44	1.88	0.49

696 *Note.* * $p < .05$, $n = 175$.

697

Figure captions

698 Table1: Theoretical structure of the FVCAAS was similar to the original scale (CAAS)

699 Figure 1: Validity of the theoretical structure of the FVCAAS

700 Table 2: Factorial validity of the FVCAAS structure and its partial invariance across gender

701 Table 3: Temporal stability of the FVCAAS

702 Table 4: Theoretical validity of the FVCAAS

703 Table 5: Usefulness of the FVCAAS to measur the differences amongst athletes' groups