

This is an Open Access document downloaded from ORCA, Cardiff University's institutional repository:<https://orca.cardiff.ac.uk/id/eprint/143136/>

This is the author's version of a work that was submitted to / accepted for publication.

Citation for final published version:

Zacharopoulos, George, Hanel, Paul H.P., Wolfradt, Uwe, Maio, Gregory R. and Linden, David E. J. 2021. The relations between pathological personality traits and human values. *Personality and Individual Differences* 179 , 110766.
10.1016/j.paid.2021.110766

Publishers page: <https://doi.org/10.1016/j.paid.2021.110766>

Please note:

Changes made as a result of publishing processes such as copy-editing, formatting and page numbers may not be reflected in this version. For the definitive version of this publication, please refer to the published source. You are advised to consult the publisher's version if you wish to cite this paper.

This version is being made available in accordance with publisher policies. See <http://orca.cf.ac.uk/policies.html> for usage policies. Copyright and moral rights for publications made available in ORCA are retained by the copyright holders.



1 **Abstract**

2 Pathological personality traits are an important inhibitor of social functioning and well-being.
3 Individual human values also possess important connections to both personality and well-
4 being, but the links between human values and pathological personality traits have not been
5 directly examined. Across two studies ($N = 478$), we provide the first direct examination of
6 these relations by employing linear and sinusoidal methodologies assessing relations between
7 Schwartz's circular model of human values (Schwartz, 1992) and a series of personality
8 measures, including the Personality Inventory for the DSM-5 (e.g., Callousness, Intimacy
9 avoidance, Rigid perfectionism). Data for Study 1 was collected in Germany and data for
10 Study 2 in the UK. Self-transcendence values buffer against several pathological personality
11 traits that constrain psychological well-being (e.g., callousness). Conversely, self-
12 enhancement values (which are motivationally opposite to self-transcendence values in
13 Schwartz's circular model of human values) were positively associated with these personality
14 traits. Several pathological personality traits were related to the 10 value types in a sinusoidal
15 waveform that was consistent with Schwartz's circular model of human values. Findings were
16 overall consistent across samples from both countries. The results help us move closer to
17 distinguishing between different processes underpinning the associations between personality
18 traits and human values.

19

20 **Keywords:** Human Values, Personality, Psychopathology, Linear associations, Sinusoidal
21 associations

22

23 **1. Introduction**

24 Human values are abstract ideals that people consider to be important guiding principles in
25 their lives, such as achievement, freedom, power, and equality (Rokeach, 1973; Schwartz,
26 1992). As such, these ideals play an important role in diverse attitudes and behaviour (Boer &
27 Fischer, 2013; Roccas & Sagiv, 2017), which makes them highly relevant for understanding
28 personality functioning and psychological well-being (Maio, 2016). Yet, the links between
29 values and relevant personality traits that can impact psychological well-being have not been
30 examined directly. Here, we provide a new and rigorous examination of this question across
31 two countries.

32 *1.1 Background*

33 It is frequently suggested that some values support psychological well-being and others act
34 against it (for reviews see Boer, 2017; Sagiv et al., 2004; Schwartz & Sortheix, 2018).
35 This account is related to a common distinction between intrinsic and extrinsic values.
36 Intrinsic values are inherently satisfying to pursue, as they are directly relevant to important
37 psychological needs, such as autonomy, competence, and relatedness (Ryan & Deci, 2000).
38 In contrast, extrinsic values are less directly satisfying of psychological needs, because they
39 are more likely to involve contingent or unstable self-esteem, non-enjoyable or even
40 demeaning activities, and external pressures (Kasser, 2002). Psychological well-being is
41 positively related to achievement values (Oishi et al., 2009), intrinsic values (Sheldon, 2005),
42 and benevolence values (Kasser & Ryan, 1993) while being negatively associated with
43 extrinsic values (Kasser & Ryan, 1993).

44 This distinction between intrinsic and extrinsic values conceptually overlaps with
45 Schwartz's circular model of values (Schwartz, 1992) (Fig. 1A). Unlike other human values
46 models, this model has been extensively studied in the context of psychological well-being in
47 general and has been supported by diverse types of correlational and experimental evidence

48 (Maio, 2016). The model enables specific predictions regarding different values. For
49 example, psychological well-being is likely to be promoted by values that promote growth
50 needs (hedonism, stimulation, self-direction, universalism, benevolence, achievement, Fig.
51 1A) and undermined by values that address deficiency needs (conformity, tradition, security,
52 power, Fig. 1A) (Bilsky & Schwartz, 1994). Several studies (cited in Boer, 2017; Haslam et
53 al., 2009) support this prediction. For instance, the affective component of psychological
54 well-being is positively related to people's endorsement of self-direction, achievement, and
55 stimulation values, while being negatively associated with people's endorsement of security,
56 conformity, and tradition values (Sagiv & Schwartz, 2000). Similarly, positive affect is
57 positively related to endorsement of self-direction, stimulation, and universalism values,
58 while being negatively associated with endorsement of power and conformity (Roccas et al.,
59 2002).

60 Furthermore, people who value self-direction, universalism, and benevolence are
61 more likely to perceive others to value those values (Hanel et al., 2018), which can increase
62 people's well-being (Sagiv & Schwartz, 2000). However, it is also possible that happy people
63 have more cognitive resources to care about others (benevolence and universalism) or be
64 independent (self-direction; see also Schwartz & Sortheix, 2018).

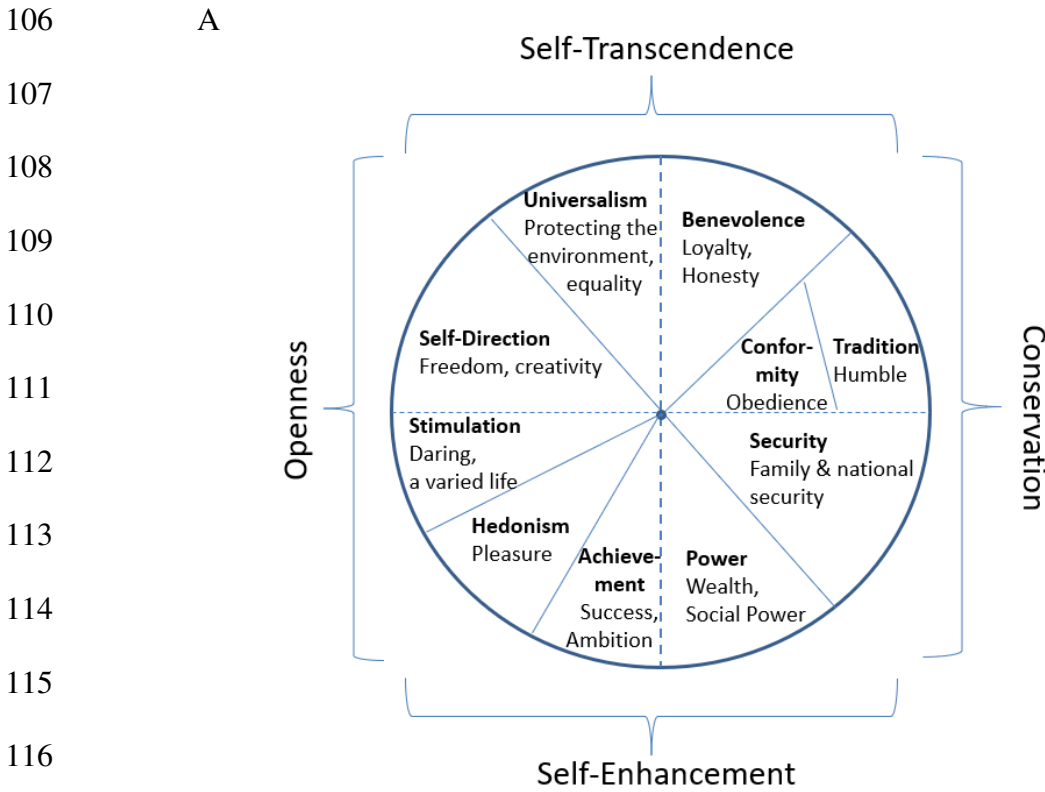
65 However, little attention has been given to associations between values and
66 pathological personality traits and other clinically relevant constructs that undermine
67 psychological well-being. For example, pathological traits such as antagonism (e.g.,
68 manipulateness, deceitfulness), disinhibition (e.g., irresponsibility, impulsivity), and
69 detachment (e.g., withdrawal, anhedonia) are negatively associated with various measures of
70 well-being (Góngora & Castro Solano, 2017). Only a few studies investigated the
71 associations between values, psychopathology (e.g., schizotypy; Hanel & Wolfradt, 2016),
72 and prominent antisocial traits, especially the so-called Dark Triad (i.e., machiavellianism,

73 narcissism, and psychopathy Paulhus & Williams, 2002). For example, several studies overall
74 found that the three dimensions of the Dark Triad and sadism were positively correlated with
75 achievement and power values but negatively associated with universalism and benevolence
76 (Balakrishnan et al., 2017; Jonason et al., 2015; Kajonius et al., 2015). The underlying
77 motives for the Dark Triad are self-serving, typically at the expense of other people (Furnham
78 et al., 2013), which might explain why the Dark Triad is negatively associated with values
79 that are self-transcending and positively associated with values which are self-enhancing.

80 In the present research, we are going significantly beyond past research by
81 investigating the associations between values with a wide range of personality traits to better
82 understand the underlying associations. Specifically, we hypothesize that particular human
83 values as assessed from Schwartz' model (Schwartz, 1992) will be associated with personality
84 traits that undermine psychological well-being in healthy participants, such as the 25 traits
85 assessed in the Personality Inventory for the DSM-5 (PID-5). Other relevant traits are
86 assessed by (i) the Schizotypal Personality questionnaire assessing schizotypy, the motivation
87 scales (ii) BIS/BAS examining behavioural inhibition and behavioural activation, (iii)
88 Temps-A assessing temperament, (iv) Vancouver Obsessional Compulsive Inventory, the (v)
89 UPPS-P Impulsive Behaviour Scale examining impulsivity and compulsivity respectively,
90 and (vi) the six HEXACO personality traits (humility, emotional stability or neuroticism,
91 extraversion, agreeableness, conscientiousness, and openness). High levels of honesty-
92 humility and extraversion putatively relate to high psychological well-being while
93 compulsivity, impulsivity, neuroticism, and schizotypy correlate with lower psychological
94 well-being (Aghababaei & Arji, 2014; Carter et al., 2016; Emmons & Diener, 1986; Fumero
95 et al., 2018; Gale et al., 2013; Pavot et al., 1990). Moreover, these relations should reveal a
96 sinusoidal waveform when plotted with value types arrayed along an x-axis in their order of
97 placement along the value circle's circumference. Three examples of putative waveforms are

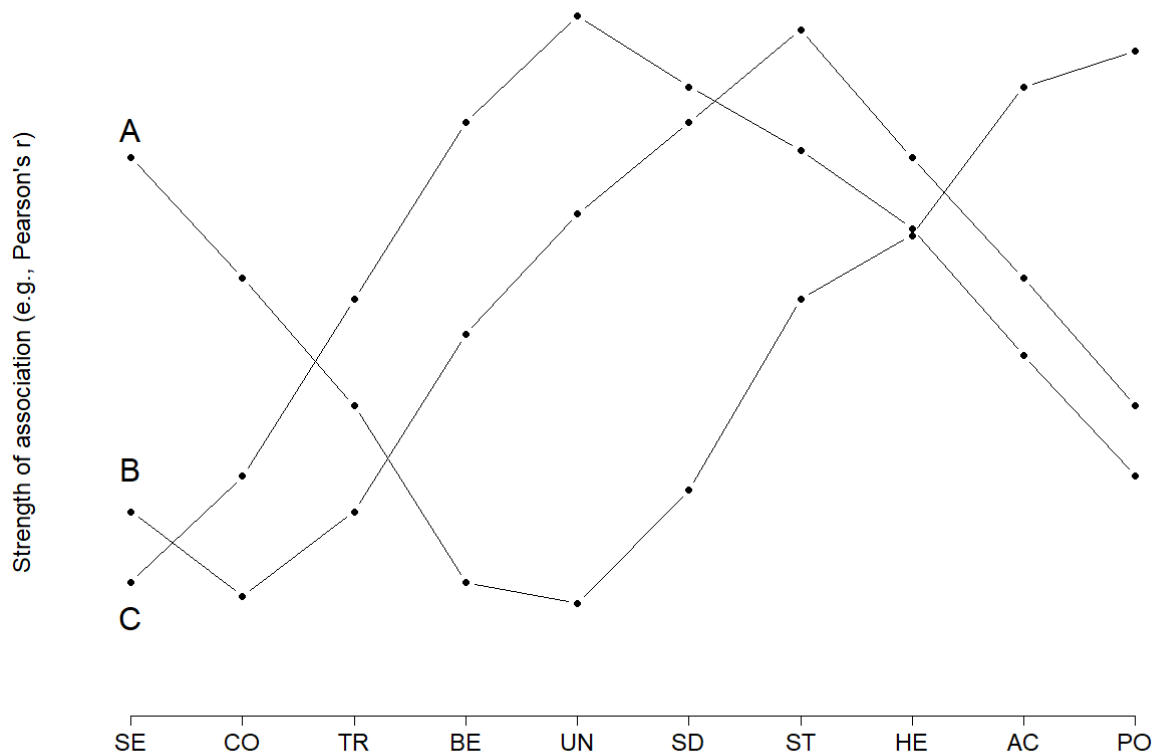
98 shown in Fig.1B. For example, pathological traits (hostility, grandiosity) might be positively
 99 correlated with achievement and power, uncorrelated with orthogonal values such as
 100 stimulation and conformity, and negatively correlated with benevolence and universalism
 101 (Fig.1B, line A). The resulting waveform resembles a sine wave. But this waveform has not
 102 yet been tested for its reliability in the context of wide range of traits related to personality.

103 **Fig. 1.** A: The circumplex structure of personal values. B: Plot of hypothesized
 104 relationships between three external variables (line graphs A, B and C) and the 10 values
 105 from the circumplex structure.



117 B

118



119

120

Note. PO: power; AC: achievement; HE: hedonism; ST: stimulation; SD: self-

121

direction; UN: universalism; BE: benevolence; TR: tradition; CO: conformity; SE: security.

122

Each dot/point could represent a correlation coefficient (Fig. 1A: Copied under a CC BY

123

licence from Hanel, 2016; Fig. 1B: Redrawn based on the concept proposed by Schwartz,

124

1992).

125

The prediction of a sinusoidal waveform is a powerful aspect of Schwartz's model,

126

but another important aspect is the support obtained across samples from over 80 nations

127

(Schwartz et al., 2012). Such extensive cross-cultural support may imply that values express

128

evolutionarily conserved motives. Indeed, using a twin-study methodology, previous research

129

demonstrated that the shared variance between human values and personality traits has a

130

significant heritable component (Schermer et al., 2008; Schermer et al., 2011), paving the

131

way for testing whether human values are related to specific personality genetic components

132

(for an overview see Fischer, 2017). There is now evidence showing a direct link between the

133 values assessed in Schwartz's model and several neurobiological markers including cortical
134 (Zacharopoulos et al., 2017), subcortical (Zacharopoulos, Lancaster, Bracht, et al., 2016) and
135 genetic data (Zacharopoulos, Lancaster, Maio, et al., 2016). Zacharopoulos and colleagues
136 (Zacharopoulos, Lancaster, Maio, et al., 2016) found that human values are related in a
137 sinusoidal manner to the polygenic score for neuroticism (which is itself linked to
138 psychopathology Van Os et al., 2001). Nonetheless, there are various indicators of
139 personality psychopathology that have not yet been linked to values in past research.

140 *1.2 The Present Research*

141 The present research provides a comprehensive examination of the link between
142 measures assessing pathological personality traits and human values. Based on the research
143 described above, we postulate that intrinsic values (e.g., hedonism, stimulation, and self-
144 direction) will be negatively associated, whereas extrinsic values (e.g., achievement and
145 power) will be positively associated with pathological personality traits. Specifically, Study 1
146 (conducted in Germany) tested these proposed relations between personality psychopathology
147 and values using the PID-5, and in Study 2 (conducted in Wales), we replicated and extended
148 the findings using various other measures, including schizotypy, compulsivity, and
149 impulsivity.

150 **2. Study 1**

151 *2.1 Method*

152 *2.1.1 Participants*

153 Three-hundred ninety-one individuals studying various academic subjects at the Martin-
154 Luther University Halle-Wittenberg (Germany) who were between 18 and 39 (304 women;
155 mean age=21.51 ± 3.73 SD) participated in the study. The study was in line with the ethical
156 requirements of the Institute of Psychology at Martin-Luther University Halle-Wittenberg.
157 Participants were verbally informed that the study was about personality and values, that their

158 participation was voluntary, and their responses would be anonymous. Data collection took
159 place during class hours in one large lecture hall. In line with the local common practice, the
160 researchers implied consent when the participants remained in the lecture hall and started
161 completing the survey (a few students decided not to participate and left). After completion,
162 which took 30-40 minutes, participants were debriefed. The data were collected in
163 Halle/Saale (Germany).

164 *2.1.2 Procedure*

165 First, participants completed the short version of the Schwartz Value Survey (SSVS)
166 (Lindeman & Verkasalo, 2005) in its German translation (Boer, 2014). The SSVS consists of
167 ten items, one for each value type in Schwartz's circular model of values (Schwartz, 1992).
168 For example, power was measured with "*Power*. (Social status and prestige, control or
169 dominance over people and resources)." Participants rated the importance of their values on a
170 6-point scale, ranging from 1 (completely unimportant) to 6 (very important). The reliability
171 and validity of the SSVS were found to be good (Lindeman & Verkasalo, 2005). For
172 example, a multidimensional scaling analysis using Torgerson revealed that the ten items
173 replicated Schwartz's model (Schwartz, 1992) (cf. Fig. 1A), thus indicating that the
174 correlations among the value type items were as proposed. Supplementary Material 1 .1
175 shows only two minor deviations: The position of achievement and power was reversed, as
176 was the position of security and tradition/conformity. Deviations within one higher order
177 value type (e.g., conservation) are considered as unproblematic and in line with the model
178 prediction (Bilsky et al., 2011). In scoring the responses, we followed the recommendation to
179 center the values on an individual basis (Schwartz, 1992, 2003).

180 Next, participants completed the full Personality Inventory for DSM-5 (PID-5) with
181 220 items (Association, 2013). The PID-5 assesses 25 personality trait facets: anhedonia,
182 anxiousness, attention-seeking, callousness, deceitfulness, depressivity, distractibility,

183 eccentricity, emotional lability, grandiosity, hostility, impulsivity, intimacy avoidance,
184 irresponsibility, manipulativeness, perceptual dysregulation, perseveration, restricted
185 affectivity, rigid perfectionism, risk-taking, separation insecurity, submissiveness,
186 suspiciousness, unusual beliefs and experiences, and withdrawal. Example items included
187 "I'm good at making people do what I want them to do" (manipulativeness), "I can be mean
188 when I need to be" (hostility), and "I usually do what others think I should do"
189 (submissiveness). Responses were given on a 4-point scale, ranging from 0 (very false or
190 often false) to 3 (very true or often true). The internal consistency of the PID-5 was
191 acceptable to very good (see Table 1). Since several variables were not normally distributed
192 when statistically assessed for normality, we additionally report the results based on
193 Spearman correlations, which produced similar results as can be seen in Supplementary
194 Material 2.1.

195 ***2.2 Sinusoidal Relationship Analyses***

196 To test the sinusoidal prediction of Schwartz's model (Schwartz, 1992), we utilized a
197 recently developed sinusoidal test (Hanel et al., 2017; Zacharopoulos et al., 2017;
198 Zacharopoulos, Lancaster, Maio, et al., 2016). For the full description of the sinusoidal
199 relationship analyses, please see Supplementary Material 3. In short, it tests how well the 10
200 correlation coefficient can be described by a sine wave. The test returns the *Sinusoidal Fit*
201 *Index* (SFI) which ranges between 0 (perfect fit) and 1 (very poor fit).

202 ***2.3 Results***

203 A summary of the results can be found in Table 1. The focus of the present analysis is
204 the correlation pattern. This pattern allows us to differentiate which value types are associated
205 with pathological personality traits. The correlations' magnitude was mostly small, consistent
206 with previous research (Hanel & Wolfradt, 2016), but in line with the predicted pattern. For
207 example, power tended to correlate more positively with callousness, deceitfulness, and

208 grandiosity, whereas benevolence correlated mostly negatively with these traits. We
209 computed 10 one-sample t-tests to ascertain whether the correlation coefficients are
210 significantly above or below 0. The 25 PID-facets were, on average, positively associated
211 with power ($p < .001$) and hedonism ($p = .002$), but negatively with benevolence and
212 tradition (both $ps < .001$). The remaining six value types were often unrelated to the PID-
213 facets.

214 To further investigate whether different values types are differentially associated with
215 the PID-5 facets, we investigated whether the correlation coefficients of the value type power
216 and each PID-5 facet are significantly different from the correlations between the value type
217 benevolence and each PID-5 facet, using Fisher's r-to-z transformation (two-tailed p-values in
218 Table 1, last column). We focused on power and benevolence because they were on average
219 most strongly correlated with the PID-5 facets. The differences between the correlation
220 coefficients (power vs benevolence) across PID-5 facets were often large. Overall, the 25
221 PID-5 facet correlations with power were significantly different from the corresponding
222 correlations with benevolence, $t(24) = 6.54$, $p < .001$, $d = 2.44$), because the sign of the
223 correlation coefficients was often in the opposite direction.

224 After investigating the linear associations, we tested the sinusoidal patterns of
225 association between the human values and each of the 25 PID-5 facets. We placed the 10
226 human values types on the x-axis in an order that follows the circular structure (Fig. 1) and
227 plotted the ten correlation coefficients between each of the 10 human value types (x-axis,
228 power, achievement, hedonism, stimulation, self-direction, universalism, benevolence,
229 tradition, conformity, security) and the 25 PID-5 facets (y-axis). We then applied the
230 Sinusoidal Fit Index to test whether the 10 points (i.e., correlation coefficients) followed a
231 sine-wave. Results indicated a robust sinusoidal pattern of association between the 10 human
232 value types and separation insecurity (SFI=.07), but not for any other variables obtained from

233 Study 1. The results were very similar when we computed Spearman's rank correlation
 234 coefficients (see Supplementary Materials 2.1).

235 **Table 1**

236 Statistical results summary from Study 1

	PO	AC	HE	ST	SD	UN	BE	TR	CO	SE	SFI	R ²	α	P>B
Anhedonia	.17***	.11*	-.09	-.22***	-.03	.11*	-.12*	-.09	.10*	.05	.68	.19	.85	<.001
Anxiousness	.09	.11*	.03	-.20***	-.15**	0	-.09	-.07	.09	.15**	.30	.10	.90	.029
Attention seeking	.18***	.06	.18***	.02	.08	-.06	-.07	-.13**	-.13**	-.16**	.34	.11	.87	.002
Callousness	.40***	.15**	.12	-.09	.05	-.16**	-.23***	-.09	-.19***	-.08	.40	.27	.85	<.001
Deceitfulness	.31***	.12*	.14**	-.10*	.04	-.12*	-.15**	-.17***	-.10*	-.01	.33	.16	.88	<.001
Depressivity	.13**	.01	.02	-.14**	-.04	.11*	-.09	-.12*	.09	.03	.78	.12	.93	.008
Distractibility	.04	-.17***	.17***	0	.03	.10*	0	-.14**	.06	-.05	.87	.11	.85	NS
Eccentricity	.12*	.03	.10*	.05	.12*	.07	-.11*	-.15**	-.07	-.16**	.34	.08	.94	.005
Emotional lability	-.04	-.01	.06	-.08	-.08	.10*	.09	-.06	-.04	.13**	.95	.05	.85	NS
Grandiosity	.27***	.15**	.09	-.14**	.05	-.09	-.16**	-.06	-.14**	-.03	.44	.12	.78	<.001
Hostility	.26***	.10*	.19***	-.10*	.02	-.03	-.14**	-.18***	-.11*	-.05	.38	.15	.84	<.001
Impulsivity	.05	-.07	.04	.14**	.05	.02	-.02	0	-.09	-.16**	.44	.05	.83	NS
Intimacy avoidance	.12*	-.07	-.05	.04	.12*	.07	-.17***	-.03	.05	-.11*	.92	.12	.84	<.001
Irresponsibility	.07	-.03	.09	.06	.14**	.11*	.01	-.20***	-.12*	-.05	.38	.11	.71	NS
Manipulativeness	.26***	.14**	.19***	-.04	.04	-.13**	-.12*	-.13**	-.17***	-.12*	.32	.14	.80	<.001
Perceptual dysregulation	.10*	0	.05	.06	.07	.08	-.02	-.15**	-.09	-.07	.39	.06	.83	NS
Perseveration	.14**	.03	.12*	-.13**	-.04	.06	-.09	-.10*	.04	-.07	.76	.09	.80	.005
Restricted affectivity	.20***	.03	.02	-.04	.04	-.04	-.19***	-.04	.04	-.12*	.70	.12	.81	<.001
Rigid perfectionism	.18***	.16**	-.04	-.14**	-.11*	-.05	-.12*	-.04	.06	.04	.24	.08	.87	<.001
Risk taking	-.07	-.12*	.01	.41***	.17***	.04	.02	-.03	-.11*	-.30***	.32	.23	.91	NS
Separation insecurity	.13**	.02	-.02	-.18***	-.18***	-.07	-.06	.01	.15**	.13**	.07+	.08	.84	.021
Submissiveness	.04	.02	0	-.26***	-.17***	-.03	-.07	.02	.29***	.10*	.29	.14	.80	NS
Suspiciousness	.18***	.15**	-.01	-.18***	-.12*	.01	-.13**	-.10*	.07	.10*	.30	.12	.68	<.001
Unusual belief experiences	.03	-.06	.03	.05	.09	.06	-.03	-.02	-.05	-.09	.33	.02	.79	NS
Withdrawal	.11*	.04	-.02	-.16**	.03	.11*	-.22***	-.01	.08	-.01	.86	.20	.89	<.001
Mean <i>r</i>	.14	.04	.06	-.05	.01	.01	-.09	-.08	-.01	-.04				.005
R ²	.27	.18	.16	.28	.14	.15	.16	.12	.19	.19				

237 *Notes.* All R²s of the bottom row are significant at $p < .001$, all R²s of column $\geq .04$ are
 238 significant at $p < .05$. All *rs* $\geq .10$ are significant at $p < .05$, all $\geq .13$ at $p < .01$, and all *rs*
 239 $\geq .17$ at $p < .001$ (all two-tailed). Significant values are in bold. PO: Power, AC:

240 Achievement, HE: Hedonism, ST: Stimulation, SD: Self-direction, UN: Universalism, BE:
 241 Benevolence, TR: Tradition, CO: Conformity, SE: Security.

242 $*p < .05$, $**p < .01$, $***p < .001$

243 *2.4 Discussion*

244 The results indicated that individuals who attached more importance to power,
 245 achievement, and hedonism values exhibited higher pathological traits, whereas individuals
 246 who attached more importance to benevolence, tradition, and conformity exhibited lower
 247 pathological traits as assessed by the PID-5 facets. Power, achievement, and hedonism values
 248 focus on self-promotion, whereas benevolence and tradition promote getting along well with
 249 others. Thus, this pattern of associations is consistent with prior theory and evidence
 250 indicating that positive connectedness to others is a critical aspect buffering against
 251 pathological personality traits.

252 **3. Study 2**

253 Study 1 showed that some value types are systematically related to pathological
 254 personality traits. In Study 2, we tested whether these findings of Study 1 could be replicated
 255 using a different set of personality measures and self-assessment tools focusing on specific
 256 syndromes, such as impulsivity, obsessive-compulsiveness, and schizotypy.

257 *3.1 Method*

258 *3.1.1 Participants and Procedure*

259 Eighty-seven university students between 19 and 42 (56 females; mean age= $23.97 \pm$
 260 3.92 *SD*) participated in the study. Respondents were informed that the study examined
 261 value-morality judgments. They completed a measure of human values and several measures
 262 of personality and personality psychopathology. The study was approved by the ethics
 263 committee of the School of Psychology at Cardiff University (EC.12.01.10.3071).
 264 Participants provided written informed consent. Since several variables were not normally

265 distributed when statistically assessed for normality, we additionally report the results based
266 on Spearman correction, which produced similar results as can be seen in Supplementary
267 Material 2.2. The study was conducted in Cardiff, Wales (United Kingdom).

268 *3.1.2 Measures*

269 Participants completed the Schwartz Value Survey (SVS; Schwartz, 1992). This 56-
270 item scale can be used to measure the value types shown in Fig. 1. Participants were asked to
271 rate the importance of each of the 56 values as a guiding principle in their lives, using a
272 quasi-bipolar 9-point scale ranging from -1 (opposed to my values), 0 (not important), 4
273 (important), to 7 (of supreme importance). Examples of SVS items are as follows: "Equality:
274 Equal opportunity for all" (Universalism); "Pleasure: Gratification of desires" (Hedonism);
275 "Obedient: Dutiful meeting obligations" (Conformity). The average score across the 56 items
276 was calculated and subtracted from each of the 56 initial raw scores before calculating the
277 average of the value scores within each of the 10 value types. Schwartz recommends this
278 procedure to help control superfluous individual variations in rating styles (Schwartz, 1992).
279 The internal consistencies of the values scales as assessed with Cronbach's alpha were low to
280 good (>.6 for all ten value types).

281 A set of questionnaires was administered to assess personality and psychopathological
282 traits: the HEXACO Personality Inventory-Revised (HEXACO-PI-R; Lee & Ashton, 2004)
283 measured six major dimensions of personality, UPPS-P Impulsive Behaviour Scale
284 (Whiteside & Lynam, 2001) measured impulsivity, the Vancouver Obsessional Compulsive
285 Inventory (VOCI; Thordarson et al., 2004) assessed compulsivity, the Behavioural Inhibition
286 and Activation Scales (BIS/BAS; Carver & White, 1994) assessed motivation, the
287 Schizotypal Personality Questionnaire (SPQ; Raine, 1991) assessed schizotypy, and the
288 TEMPS-A-short version assessed affective temperament (Akiskal et al., 2005).

289 *3.2 Results*

290 As in Study 1, we again assessed the relations between the 10 human value types and
291 the trait measures (Table 2) while also calculating the corresponding sinusoidal fit indices.

292 Consistent with the previous findings, participants who attached higher importance to
293 benevolence values exhibited lower scores on the pathological personality traits in several
294 measures (including constricted affect, state anxiety, positive urgency, lack of premeditation,
295 obsessions), although the negative correlations did not consistently reach significance.

296 As in Study 1, we then investigated the extent to which the personality traits were
297 associated with the 10 human value types in a sinusoidal manner as predicted by Schwartz's
298 circular model of values (Schwartz, 1992). We consider any sinusoidal associations with an
299 SFI score of less than .20 to be significant. Results indicated a robust sinusoidal pattern of
300 association between the 10 human value types and Reward Responsiveness (SFI=.16) from
301 BAS, Agreeableness (SFI=.16) from HEXACO, and Checking (SFI=.12) from VOCL.

302

303

304 **Table 2**

305 Statistical results summary from Study 2.

	PO	AC	HE	ST	SD	UN	BE	TR	CO	SE	SFI	R ²	P>B
BIS/BAS													
Drive	.109	.201	.147	.283**	.07	-.192	-.294**	-.065	-.115	-.008	.20	.233*	<.05
Fun-seeking	-.095	-.172	.145	.353**	-.007	.058	-.06	.025	.081	-.079	.74	.214*	NS
Reward responsiveness	.208	.129	.192	.212*	-.085	-.248*	-.218*	-.072	-.069	.146	.16	.161	<.05
BIS	.12	.186	-.096	-.220*	-.127	-.196	.059	.172	-.077	-.023	.60	.232*	NS
SPQ													
Ideas of reference	.082	-.083	-.052	-.133	-.061	-.007	-.203	.053	.024	.135	.53	.127	NS
Odd beliefs or magical thinking	-.032	-.106	-.196	-.031	.039	.101	-.044	-.025	.045	.068	.62	.079	NS
Unusual Perceptual Experiences	-.104	-.036	-.039	.029	.129	.106	-.11	-.065	.015	-.016	.64	.056	NS
Odd or Eccentric Behaviour	-.279**	-.028	-.143	.13	.330**	.333**	-.074	-.102	-.116	-.151	.27	.243*	NS
Excessive social anxiety	-.018	-.005	.024	-.077	.124	.096	-.16	.042	-.174	.089	.91	.124	NS
No close friends	-.006	-.058	-.081	-.026	.176	.124	-.16	.071	-.116	-.024	.79	.157	NS
Odd speech	-.208	-.243*	-.039	.024	.184	.221*	-.065	.045	-.055	-.02	.35	.182	NS
Constricted affect	-.049	-.068	.003	.085	.211	.195	-.247*	.068	-.063	-.105	.63	.215*	NS
Suspiciousness	.086	-.075	-.071	-.113	-.099	-.036	-.21	.161	-.007	.247*	.49	.142	NS
TEMPS-A													
Cyclothymic	-.177	-.001	-.077	.094	.164	.156	-.106	-.006	-.142	-.12	.29	.124	NS
Dysthymic	.067	.017	-.081	-.034	.204	.212	-.158	-.116	-.088	-.101	.73	.156	NS
Irritable	-.075	.01	.079	.099	.059	.003	-.248*	.027	-.026	.033	.72	.114	NS
Hyperthymic	-.011	.081	-.125	.282**	.028	-.048	-.021	-.118	.144	-.12	.89	.174	NS
Anxious	.059	.08	.017	-.125	-.204	-.107	-.132	.074	-.075	.240*	.33	.174	NS
UPPS-P													
(Negative) Urgency	.097	-.016	.214*	.042	-.11	-.007	-.245*	.015	-.1	.087	.53	.144	NS
(lack of) Premeditation	.009	.052	.254*	.305**	.066	.101	-.355**	-.113	-.203	.133	.38	.252*	<.05
(lack of) Perseverance	.032	-.138	.201	.023	-.06	.057	-.159	.202	-.032	.019	1.0	.163	NS
Sensation seeking	-.232*	-.094	.006	.349**	.091	.053	-.171	.002	.274*	-.002	.90	.314**	NS
(Positive) Urgency	.058	-.078	.117	.088	-.016	.091	-.295**	.036	-.071	-.015	.78	.151	<.05
VOCI													
Contamination	.118	-.073	.068	-.098	-.127	.063	-.18	.051	-.041	.246*	.65	.184	NS
Checking	.118	.107	-.005	-.094	-.197	-.186	-.107	.04	.041	.309**	.12	.153	NS
Obsessions	.11	-.041	-.029	.052	.006	.045	-.214*	-.017	-.015	.118	.77	.080	NS
Hoarding	-.001	-.007	.035	.047	-.005	.146	-.185	.022	-.207	.142	.87	.164	NS
Just Right	.054	-.049	-.177	-.065	.062	.078	-.17	-.043	.087	.112	.85	.141	NS
Indecisiveness	.171	.06	-.012	-.061	-.007	-.093	-.056	-.028	-.029	.067	.30	.051	NS
VOCI Total	.128	-.006	-.047	-.05	-.048	.01	-.191	.002	-.019	.2	.52	.108	NS
HEXACO													
Honesty-Humility	-.481***	-.229*	-.274*	-.184	.165	.327**	.398***	-.052	.109	-.181	.18	.348***	<.001

Pathological Personality Traits and Human Values-- 16

Emotionality	.211*	.13	-.094	-.250*	-.303**	-.247*	.182	-.013	.027	.098	.35	.337***	NS
Extraversion	-.011	-.029	.012	.076	-.03	.014	.048	.056	-.026	-.102	.66	.032	NS
Agreeableness	-.228*	-.125	-.111	-.144	-.057	.126	.288**	.137	.078	-.127	.16	.144	<.01
Conscientiousness	-.047	.037	-.257*	-.113	.012	-.137	.161	-.122	.267*	.077	.65	.216*	NS
Openness	-.328**	.019	-.149	.162	.511***	.407***	.059	-.331**	-.272*	-.195	.24	.356***	<.05
Altruism	-.269*	-.143	-.191	-.229*	-.116	.123	.434***	-.012	-.004	-.107	.33	.317***	<.001
STATE ANXIETY	.078	.086	.002	.055	.167	.083	-.238*	-.088	-.038	-.113	.56	.132	NS

306

307 *Notes.* * $p < .05$, ** $p < .01$, *** $p < .001$, SFI= sinusoidal fit index, R^2 : the amount of
 308 explained variance with the value types as predictors and the variable in the first column as
 309 the dependent variable, P>B: p-value when investigated whether the correlation coefficients
 310 of the value type power and each variable in the first column facet are significantly different
 311 from the correlations between the value type benevolence and that variable, using Fisher's r-
 312 to-z transformation.

313 3.3 Discussion

314 The results indicated that individuals who attached more importance to power and
 315 achievement values exhibited on average higher scores on obsessional compulsiveness
 316 (VOCI) and drive, whereas individuals who attached more importance to benevolence and
 317 universalism exhibited lower scores on these measures. Consistent with the aforementioned
 318 link between benevolence values and connectedness to others (Study 1 Discussion), it is also
 319 noteworthy that participants who attached more importance to self-transcendence values
 320 (e.g., benevolence) or less importance to self-enhancement values (e.g., power, achievement)
 321 scored higher on several personality traits that promote good relations with others, including
 322 honesty-humility and agreeableness.

323 4. General Discussion

324 The present research provides a novel investigation of the linear and sinusoidal
 325 associations between values and a wide range of measures assessing pathological personality
 326 traits as well as non-clinical personality traits. Two main results emerged from this research.

327 First, we demonstrated across two studies conducted in Germany and the United Kingdom,
328 that benevolence and some conservation values (but only in the German sample) buffer
329 against several pathological personality traits that constrain psychological well-being.
330 Conversely, self-enhancement values (especially power) were positively associated with
331 these psychological tendencies.

332 Interestingly, benevolence was more strongly negatively associated with many
333 psychopathological traits than universalism. We believe this is because people higher in
334 benevolence care more for “people with whom one is in frequent personal contact” whereas
335 people higher in universalism care more for humanity in general (Schwartz, 1992). Many of
336 the psychopathological traits we investigated have negative consequences for people with
337 whom one is in close contact (e.g., callousness, hostility, obsessions).

338 It is worth noting that tradition was negatively associated with a range of pathological
339 traits including deceitfulness, hostility, or irresponsibility in the German sample but not in the
340 British sample (i.e., Study 1 but not Study 2). This suggests that valuing tradition can buffer
341 against pathological traits that might have direct negative consequences for other people.
342 Indeed, the goal of tradition values is “respect, commitment, and acceptance of the customs
343 and ideas that one's culture or religion impose on the self” (Schwartz, 1992). In contrast,
344 hostility, deceitfulness, and irresponsibility are strong indicators of disrespecting others.
345 However, we can only speculate why these associations appeared only in the German sample
346 but not the British sample. In terms of cultural values, average income, life expectancy, or
347 education levels, the UK and Germany are very similar (Hofstede, 2001; UNDP, 2015).

348 However, one noticeable difference is the number of young people who identify
349 themselves as religious. Among 16 to 29-year-olds, 45% of Germans but 70% of British
350 participants identified themselves as non-religious (Bullivant, 2018). This difference can

351 contribute to explaining the different patterns of correlations we obtained, assuming that
352 higher levels of religiosity increase the likelihood of being in a religious community. For
353 example, Hanel et al. (Hanel et al., 2019) sampled students studying the same subject at the
354 same institution as our Study 1 participants, albeit from a different cohort. The authors found
355 that religiosity, which is strongly associated with tradition values (Saroglou et al., 2004),
356 tended to be negatively associated with schizotypy, another pathological trait, but only among
357 those students who were members of a religious community. That is, a higher percentage of
358 German participants might have been a religious community member than the British
359 participants, which could potentially explain this difference. Moreover, PID-5 and HEXACO
360 are trait-based measures. Such measures usually rely on factor analyses of the results which
361 are not always replicable as they can vary between samples and depend on several factors,
362 including the variables inserted in the analysis (Goldberg, 1992). Moreover, it was previously
363 argued that only certain traits (extraversion, agreeableness, and conscientiousness) were
364 replicated across cultures, and other studies found inconsistent results regarding the sixth-
365 factor dimensions (Becker, 1999; De Raad et al., 2010; Thalmayer et al., 2011). Nevertheless,
366 future research is needed to shed more light onto this cross-country difference in these
367 correlations.

368 Second, by employing a recently developed methodology to detect sinusoidal patterns
369 specifically, we were able to capture all of the available information in the relations between
370 human values and pathological personality traits. In particular, we detected robust sinusoidal
371 relationships with a range of traits (including Reward Responsiveness from BAS,
372 Agreeableness from HEXACO and Checking from VOCI, Separation Insecurity from 25
373 PID-5 facets). Of additional interest, the individual correlations between the pathological
374 personality traits and human values were often below conventional levels of significance
375 when viewed individually. Still, the pattern was highly reliable when viewed together using

376 the sinusoidal test. The sinusoidal approach has two important advantages. First, a single SFI,
377 as opposed to a single correlation, is calculated by taking into account the association
378 between an external variable and all 10 human values at a time; the number of comparisons
379 when using this approach is reduced 10 times. Second, this approach allows researchers to
380 detect sinusoidal links that are undetectable at the linear level. The findings extend our
381 previous demonstrations of the utility of the sinusoidal methodology for testing theoretical
382 predictions from Schwartz's circular model of values (Schwartz, 1992), and we recommend
383 its use in future research using the model.

384 In both studies, we used different measures for values and psychopathological
385 constructs in samples from two countries. This was done to test whether our findings are
386 independent of specific measurements and are robust across countries (Boer et al., 2011).
387 Further, since our results are cross-sectional, we do not know whether values impact
388 psychopathological traits or vice versa. Recent evidence suggests that the link between values
389 and well-being is bi-directional (Grosz et al., 2021), but it is unclear whether this generalises
390 to personality traits.

391 **5. Conclusion**

392 In sum, our results are consistent with the hypothesis that some values (i.e., self-
393 transcendence) support personality traits underpinning well-being, while other values (i.e.,
394 self-enhancement) oppose these traits. These findings might pave the way for developing
395 human value change interventions to cultivate dispositions that support well-being. Indeed,
396 several studies have found that human values are malleable (Çileli, 2000; Inglehart, 1997;
397 Klages, 2005; Sheldon, 2005; Verkasalo et al., 2006), and some interventions have been
398 successful at changing values (Bardi & Goodwin, 2011; but see Manfredi et al., 2017 for an
399 opposing view). These include interventions that ask participants to generate reasons for
400 values (Bernard et al., 2003), or deliver feedback that challenges individuals to consider the

401 fit between their values and self-concept (Maio et al., 2009; Rokeach, 1975). The use of these
402 methods may also lead to additional insights into the mechanisms through which values and
403 personality psychopathology are interlinked. Lastly, our findings will motivate future studies
404 examining the predictive role of human values in developing personality psychopathology in
405 clinical populations.

406

407

408

409

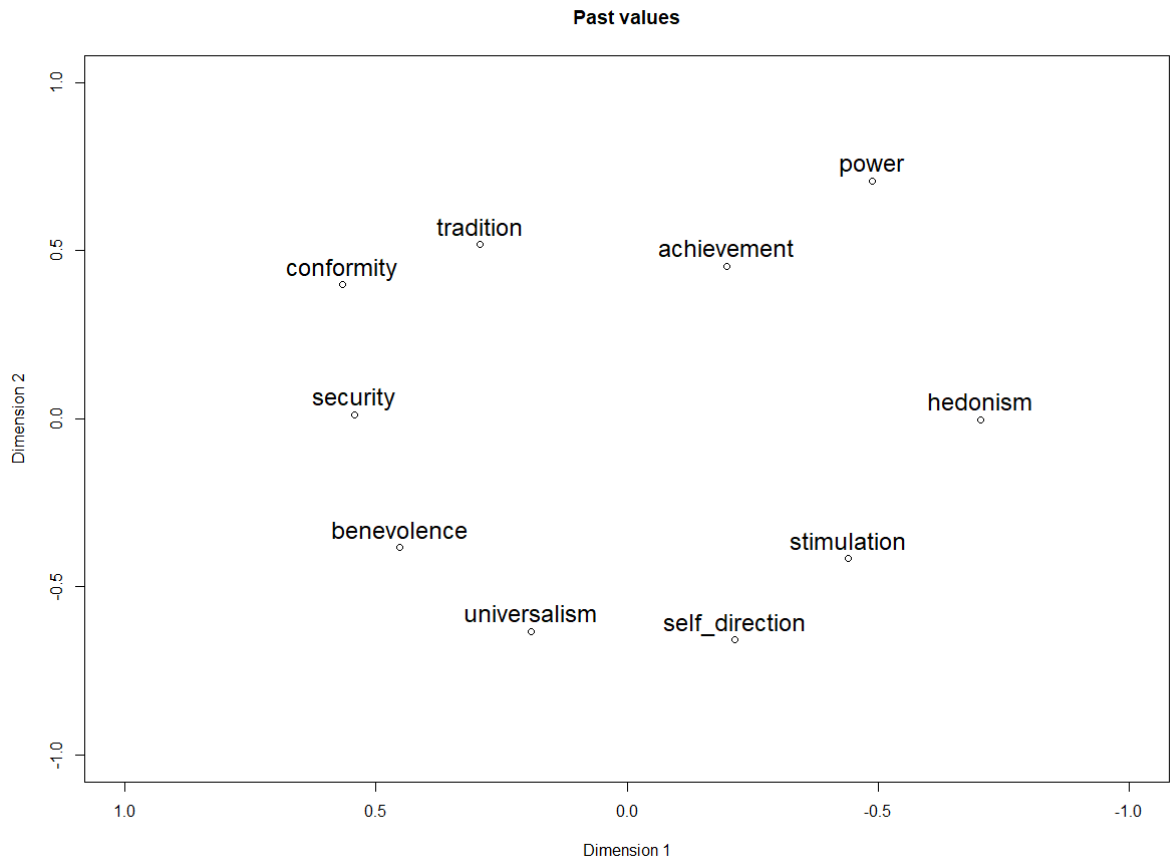
410

411 **Supplementary Material**

412 **Supplementary Material 1.**

413 *1.1. Result of a multidimensional scaling analysis from our Study 1 with the Short*

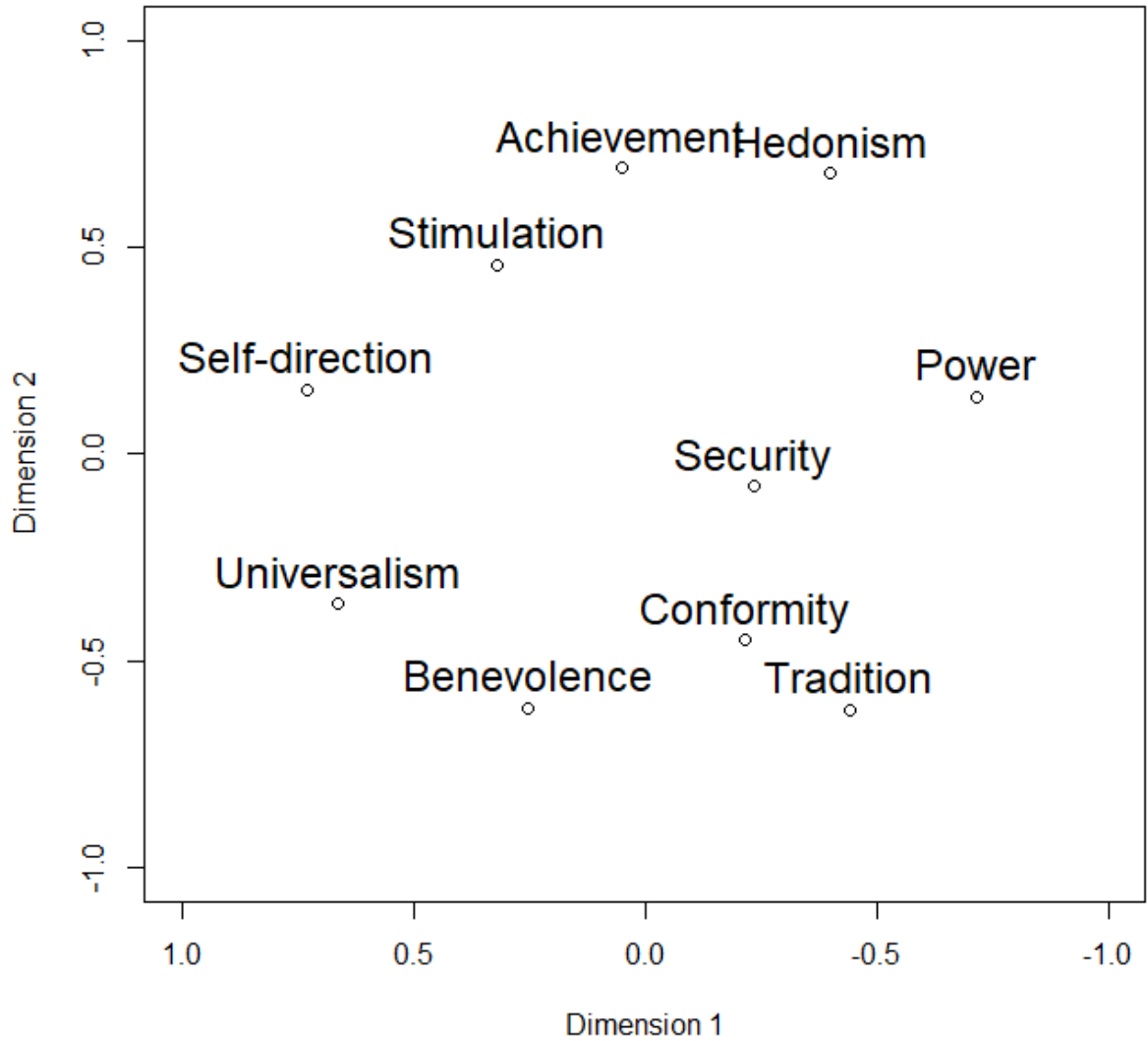
414 *Schwartz's Value Scale.*



415

416 *1.2. Result of a multidimensional scaling analysis from our Study 2 with the*

417 *Schwartz's Value Scale.*



418

419

420

421

422 **Supplementary Material 2**

423 *2.1. Replication of the main analyses when using Spearman correlations in Study 1.*

	PO	AC	HE	ST	SD	UN	BE	TR	CO	SE	SFI	R ²	α	P>B
Anhedonia	0.15	0.14	-0.09	-0.21	-0.05	0.11	-0.07	-0.08	0.10	0.06	0.66	.19	.85	<.001
Anxiousness	0.07	0.12	0.02	-0.21	-0.14	0.03	-0.04	-0.07	0.10	0.17	0.40	.10	.90	.029
Attention seeking	0.17	0.06	0.18	0.05	0.08	-0.06	-0.05	-0.11	-0.10	-0.16	0.34	.11	.87	.002
Callousness	0.33	0.13	0.14	-0.01	0.05	-0.13	-0.17	-0.11	-0.14	-0.15	0.38	.27	.85	<.001
Deceitfulness	0.27	0.06	0.18	-0.09	0.04	-0.09	-0.10	-0.15	-0.03	-0.09	0.47	.16	.88	<.001
Depressivity	0.10	0.01	0.03	-0.16	-0.07	0.13	-0.01	-0.09	0.13	0.04	0.78	.12	.93	.008
Distractibility	0.06	-0.15	0.17	-0.02	0.02	0.09	-0.01	-0.14	0.07	-0.06	0.91	.11	.85	NS
Eccentricity	0.11	0.03	0.11	0.05	0.10	0.09	-0.05	-0.13	-0.03	-0.15	0.40	.08	.94	.005

Emotional lability	-0.05	-0.02	0.08	-0.12	-0.08	0.12	0.09	-0.05	-0.03	0.15	0.92	.05	.85	NS
Grandiosity	0.21	0.15	0.07	-0.13	0.05	-0.10	-0.08	-0.04	-0.12	-0.06	0.53	.12	.78	<.001
Hostility	0.25	0.07	0.21	-0.11	0.00	-0.05	-0.12	-0.17	-0.08	-0.08	0.43	.15	.84	<.001
Impulsivity	0.04	-0.09	0.05	0.14	0.05	-0.01	-0.04	0.03	-0.05	-0.18	0.58	.05	.83	NS
Intimacy avoidance	0.12	-0.07	-0.04	0.07	0.10	0.12	-0.11	-0.03	0.05	-0.15	0.84	.12	.84	<.001
Irresponsibility	0.07	-0.06	0.13	0.04	0.11	0.13	0.01	-0.17	-0.05	-0.09	0.47	.11	.71	NS
Manipulativeness	0.23	0.10	0.22	-0.02	0.03	-0.11	-0.06	-0.10	-0.13	-0.16	0.41	.14	.80	<.001
Perceptual dysregulation	0.06	-0.03	0.06	0.04	0.04	0.10	0.03	-0.11	-0.03	-0.08	0.53	.06	.83	NS
Perseveration	0.12	0.03	0.14	-0.12	-0.05	0.06	-0.08	-0.10	0.04	-0.08	0.77	.09	.80	.005
Restricted affectivity	0.18	0.05	0.03	-0.01	0.03	-0.02	-0.08	-0.06	0.05	-0.14	0.74	.12	.81	<.001
Rigid perfectionism	0.16	0.17	-0.07	-0.15	-0.13	-0.03	-0.08	-0.05	0.05	0.05	0.31	.08	.87	<.001
Risk taking	-0.08	-0.14	0.02	0.41	0.15	0.02	0.00	-0.01	-0.07	-0.29	0.38	.23	.91	NS
Separation insecurity	0.10	0.02	0.00	-0.17	-0.20	-0.06	-0.04	0.04	0.15	0.12	0.10	.08	.84	.021
Submissiveness	0.05	0.05	-0.02	-0.23	-0.17	0.00	-0.06	0.01	0.26	0.09	0.29	.14	.80	NS
Suspiciousness	0.19	0.14	-0.02	-0.19	-0.11	-0.01	-0.11	-0.08	0.08	0.07	0.31	.12	.68	<.001
Unusual belief experiences	0.01	-0.05	0.03	0.04	0.07	0.08	0.03	-0.02	0.01	-0.10	0.34	.02	.79	NS
Withdrawal	0.08	0.08	0.00	-0.15	0.03	0.09	-0.09	-0.04	0.08	-0.04	0.91	.20	.89	<.001
Mean <i>r</i>	0.12	0.03	0.07	-0.05	0.00	0.02	-0.05	-0.07	0.01	-0.05	0.53			.005
R ²	.27	.18	.16	.28	.14	.15	.16	.12	.19	.19				

424 *Note.* All *R*²s of the bottom row are significant at *p* < .001, all *R*²s of column ≥ .04 are
 425 significant at *p* < .05. All *r*s ≥ .10 are significant at *p* < .05, all ≥ .13 at *p* < .01, and all *r*s
 426 ≥ .17 at *p* < .001 (all two-tailed). Significant values are in bold. PO: Power, AC:
 427 Achievement, HE: Hedonism, ST: Stimulation, SD: Self-direction, UN: Universalism, BE:
 428 Benevolence, TR: Tradition, CO: Conformity, SE: Security.

429

430 *2.2. Replication of the main analyses when using Spearman correlations in Study 2.*

	PO	AC	HE	ST	SD	UN	BE	TR	CO	SE	SFI	R ²	P>B
BIS/BAS													
Drive	.13	.229*	.094	.284**	.046	-.222*	-.310**	-.039	-.008	.058	.28	.233*	<.05
Fun-seeking	-.133	-.188	.157	.396***	.022	.103	-.075	.048	.07	-.091	.68	.214*	NS
Reward responsiveness	.201	.127	.230*	.183	-.036	-.272*	-.217*	-.021	-.035	.203	.19	.161	<.05
BIS	.167	.230*	-.148	-.208	-.044	-.240*	.034	.091	-.05	-.018	.62	.232*	NS
SPQ													
Ideas of reference	.079	-.04	.031	-.098	.034	.015	-.221*	-.015	.065	.068	.74	.127	NS
Odd beliefs or magical thinking	-.026	-.093	-.054	.015	-.023	-.055	-.017	-.04	-.002	.13	.83	.079	NS

Pathological Personality Traits and Human Values-- 24

Unusual Perceptual Experiences	-.108	-.008	-.002	-.004	.068	.07	-.104	-.042	.069	.016	.91	.056	NS
Odd or Eccentric Behaviour	-.255*	.033	-.151	.044	.328**	.303**	-.093	-.076	-.089	-.083	.44	.243*	NS
Excessive social anxiety	-.004	.032	.04	-.073	.093	.024	-.141	.055	-.162	.094	.90	.124	NS
No close friends	.014	-.101	-.073	-.055	.152	.105	-.181	.089	-.163	.011	.89	.157	NS
Odd speech	-.181	-.197	.03	.016	.133	.188	-.094	.043	.011	-.032	.48	.182	NS
Constricted affect	-.04	-.12	-.008	.044	.213*	.197	-.235*	.1	0	-.142	.70	.215*	NS
Suspiciousness	.028	-.108	-.004	-.055	-.098	-.042	-.257*	.173	-.006	.144	.71	.142	NS
TEMPS-A													
Cyclothymic	-.17	-.02	.003	.082	.161	.122	-.064	-.027	-.111	-.101	.16	.124	NS
Dysthymic	.054	.026	.087	-.012	.189	.209	-.147	-.108	-.183	-.05	.49	.156	NS
Irritable	-.106	.03	.082	.124	.088	.022	-.198	.043	.012	.021	.74	.114	NS
Hyperthymic	-.028	.114	-.075	.282**	.029	-.063	-.024	-.146	.182	-.131	.86	.174	NS
Anxious	.145	.045	.021	-.17	-.276*	-.154	-.139	.117	.023	.254*	.16	.174	NS
UPPS-P													
(Negative) Urgency	.138	.019	.242*	-.026	-.064	-.057	-.193	-.036	-.029	.17	.36	.144	NS
(lack of) Premeditation	.031	.001	.193	.255*	.067	.139	-.357**	-.037	-.198	.12	.53	.252*	<.05
(lack of) Perseverance	.018	-.16	.225*	.001	-.063	.067	-.191	.2	-.055	.006	.99	.163	NS
Sensation seeking	-.193	-.119	.06	.410***	.07	.087	-.175	.022	.243*	-.038	.85	.314**	NS
(Positive) Urgency	.103	-.086	.129	.051	-.006	.049	-.237*	.053	-.039	.039	.81	.151	NS
VOCI													
Contamination	.112	-.055	.109	-.088	-.18	.023	-.189	.139	-.049	.279**	.60	.184	NS
Checking Obsessions	.151	.139	.019	.034	-.124	-.230*	-.268*	.012	.055	.308**	.18	.153	<.05
	.071	.073	.065	.08	.073	.018	-.268*	-.04	-.119	.181	.52	.080	NS
Hoarding	.073	-.068	.14	.075	.006	.098	-.253*	.07	-.094	.16	.84	.164	NS
Just Right	.063	-.049	-.082	-.072	.013	-.003	-.128	.029	.131	.155	.48	.141	NS
Indecisiveness	.152	.046	.043	-.1	-.004	-.105	-.044	-.011	-.057	.126	.36	.051	NS
VOCI Total	.129	.011	.025	-.051	-.084	-.098	-.179	.078	.09	.239*	.23	.108	NS
HEXACO													
Honesty-Humility	-.443***	-.222*	-.250*	-.144	.172	.308**	.365**	-.12	.097	-.207	.21	.348***	<.001
Emotionality	.233*	.153	-.1	-.275**	-.230*	-.267*	.158	-.05	.016	.127	.36	.337***	NS
Extraversion	-.031	-.009	-.037	.18	-.163	-.122	.169	-.052	.026	-.029	1.0	.032	NS
Agreeableness	-.279**	-.15	-.139	-.15	-.006	.183	.251*	.023	.113	-.189	.19	.144	<.01
Conscientiousness	.003	.037	-.243*	-.142	.007	-.21	.181	-.114	.204	.072	.65	.216*	NS
Openness	-.388***	-.016	-.191	.155	.590***	.435***	.098	-.348**	-.212*	-.221*	.26	.356***	<.01
Altruism	-.283**	-.17	-.178	-.208	-.051	.076	.444***	-.042	-.046	-.147	.34	.317***	<.001
STATE ANXIETY	.082	.065	.107	.04	.163	.055	-.261*	-.068	-.05	-.089	.46	.132	<NS

432 Notes. * $p < .05$, ** $p < .01$, *** $p < .001$, SFI= sinusoidal fit index, R^2 : the amount of
 433 explained variance with the value types as predictors and the variable in the first column as
 434 the dependent variable, P>B: p-value when investigated whether the correlation coefficients
 435 of the value type power and each variable in the first column facet are significantly different
 436 from the correlations between the value type benevolence and that variable, using Fisher's r-
 437 to-z transformation.

438

439 **Supplementary Material 3**

440 **Sinusoidal Relationship Analyses**

441 This test examines whether values are systematically related to an external variable
 442 (e.g., anxiety). This test is important because other statistics, such as the amount of explained
 443 variance R^2 , cannot fully test the model's circular distribution. For example, a high R^2 can
 444 occur when one value type is highly correlated with an external variable, whereas the other
 445 value types are unrelated. Conversely, a low R^2 still can occur even when the value types are
 446 systematically related to the external variables in the predicted sinusoidal manner.

447 To test the sinusoidal pattern, the correlation coefficients with the 10 value types were
 448 calculated. The fit of the sinusoidal function presented below (1) was calculated using the
 449 programming language R.

$$450 \quad (1) \hat{y} = f(x) = a + b \cdot \sin(c \cdot x + d)$$

451 In equation 1, \hat{y} is the estimated numerical value (e.g., estimated correlation coefficients), x is
 452 a vector containing the numbers 1 to 10, parameter a is the y-offset that moves the function
 453 up and down along the ordinate (y-axis), parameter b determines the amplitude of the sinus
 454 wave on the y-axis, parameter c is the period of the sine wave, and parameter d (x-offset)
 455 moves the sinusoidal function along the x-axis (Hanel et al., 2017).

456 The script used to calculate the sinusoidal fit index is composed of mathematical
457 functions available in R. Here, we describe the main functions used in the Sinusoidal Fit
458 Index. To optimize the four parameters (a , b , c , d) of the sine function (equation 1) we used
459 the ‘brute force method’, an exploratory approach used to determine the starting points for
460 the actual optimization function. This determination was achieved using the R command
461 `optim` (general-purpose optimization function, [https://stat.ethz.ch/R-](https://stat.ethz.ch/R-manual/R-devel/library/stats/html/optim.html)
462 [devel/library/stats/html/optim.html](https://stat.ethz.ch/R-manual/R-devel/library/stats/html/optim.html); R version 3.6.3). The R command `optim` is often used for
463 optimizations and only searches for local minima (i.e., stabilizes to the closest local minima)
464 – as do all optimization algorithms. The `optim` function takes 4 arguments-inputs (the a , b , c ,
465 and d of the eq1) and produces 4 outputs through Nelder–Mead, quasi-Newton and
466 conjugate-gradient algorithms (Nash, 1990; Nelder & Mead, 1965). For all four parameters,
467 50 numerical values were selected, resulting in $50 \times 50 \times 50 \times 50 = 6,250,000$ combinations
468 (selection procedure further explained below). Specifically, we tested which of 6,250,000
469 combinations of the four parameters in the sinusoidal function result in a sine function with
470 the smallest deviation from the empirical data. The selection of numerical values (i.e., the
471 6,250,000 combinations) was employed to achieve a range that is as large as necessary –
472 more combinations can increase the fit slightly – but still manageable in computational terms.

473 For each parameter, the numerical values were selected from a specific range
474 according to Schwartz's theoretical predictions (Schwartz, 1992). The 50 numerical values
475 selected for the parameter a were $-1, -.96, -.92, \dots, .96, 1$. In other words, parameter a was
476 restricted between -1 to 1 because this is the possible range for a correlation coefficient. The
477 same restrictions were applied to parameter b , which determines the amplitude of the sinus
478 wave on the y -axis (i.e., the distance between the turning points of the sinusoidal function).
479 The parameter c , the period of the sine wave, was allowed to range between 85-95% of a full

480 sine wave. This restriction was based on the circular model's assumption that "the distances
 481 between the values around the circle may not be equal" (Schwartz et al., 2012).
 482 Given that the first value type was plotted at $x = 1$, the parameter d (x -offset), which moves
 483 the sinusoidal function along the x -axis, was set to the interval $[1 + 10/2, 1 - 10/2]$. The
 484 parameter d was restricted to 10, which is the number of correlation coefficients between the
 485 external variable and the 10 value types. This restriction is useful because there was no
 486 hypothesis regarding the exact starting point of the sine wave for each parameter. To be able
 487 to define a lower and upper bound given these constraints, a method developed by Byrd, Lu,
 488 Nocedal, and Zhu (Byrd et al., 1995) was used. This is a "limited memory quasi-Newton
 489 algorithm for solving large nonlinear optimization problems with simple bounds on the
 490 variables" (p. 1).

491 To estimate the model fit indices for the sinusoidal function, we calculated the sum of
 492 the squared residuals divided by the variance. This Sinusoidal Fit Index (SFI, Hanel et al.,
 493 2017) and is presented below (equation 2).

$$494 \quad (2) \text{ SFI} = \frac{\frac{1}{K-1} \sum_{k=1}^K (y_k - \hat{y}_k)^2}{\frac{1}{K-1} \sum_{k=1}^K (y_k - \bar{y}_k)^2}$$

495 In this equation (2), K represents the number of correlation coefficients, y_k represents the
 496 correlation coefficients, \hat{y}_k represents the estimated correlation coefficient through the
 497 optimization function, and \bar{y}_k represents the mean of the correlation coefficients. The
 498 denominator is the formula for the variance.

499 To obtain the number of false-positive results for the SFI, three simulations of $m =$
 500 100,000 samples each were conducted with the programming language R. To simulate a
 501 random pattern of correlation coefficients, we tested the following two assumptions regarding
 502 the distribution of the correlation coefficients. (1) We sampled 10 numbers (i.e., number of
 503 human values) between $-.5$ and $.5$, assuming a uniform distribution. The range from $-.5$ to $.5$
 504 represents the interval in which most correlations between values and external variables

505 usually fall (the pattern of results remained the same when we extended the range to -.7 to .7).

506 (2) We sampled k numbers from a normal distribution with $\sim N(0, .1)$, and (3) $\sim N(0, .3)$.

507 Numbers $>|1|$ were restricted to -1 or 1, respectively.

508 The proportion of false positives was well below 1% for all three simulations for SFI

509 $< .20$. The percentage of false positives was slightly larger if a uniform distribution was

510 assumed. The percentage of false positives for an SFI $< .20$ was 0.49 (i.e., less than 5 false-

511 positive results per one thousand comparisons), assuming a normal distribution. This means

512 that 200 SFI tests will yield merely one false-positive result. Therefore, our statistical

513 threshold is considerably more conservative than typical statistical thresholds (i.e., $p < .05$).

514 The percentage of false positives are 0.20%, 0.05% and 0.005% for SFI $< .15$, SFI $< .10$ and

515 SFI $< .05$, respectively. Please note that the main reason for our cut-off values (SFI $< .20$)

516 was the careful examination of many plots and not the simulations' results. An SFI of $> .20$

517 can still be considered as following a sine wave, but it is harder to recognize an SFI of $.30$ as

518 following a sine wave. We note that this cut-off is somewhat subjective and therefore report

519 the exact SFI-values in case readers prefer a different threshold.

520

521

522 **References**

- 523 Aghababaei, N., & Arji, A. (2014). Well-being and the HEXACO model of personality.
524 *Personality and Individual Differences, 56*, 139-142.
525
- 526 Akiskal, H. S., Akiskal, K. K., Haykal, R. F., Manning, J. S., & Connor, P. D. (2005).
527 TEMPS-A: progress towards validation of a self-rated clinical version of the
528 Temperament Evaluation of the Memphis, Pisa, Paris, and San Diego
529 Autoquestionnaire. *Journal of affective disorders, 85*(1-2), 3-16.
530
- 531 Association, A. P. (2013). *Diagnostic and statistical manual of mental disorders (DSM-5®)*.
532 American Psychiatric Pub.
533
- 534 Balakrishnan, A., Plouffe, R. A., & Saklofske, D. H. (2017). What do sadists value? Is
535 honesty-humility an intermediary? Replicating and extending findings on the link
536 between values and “dark” personalities. *Personality and Individual Differences, 109*,
537 142-147.
538
- 539 Bardi, A., & Goodwin, R. (2011). The dual route to value change: Individual processes and
540 cultural moderators. *Journal of cross-cultural psychology, 42*(2), 271-287.
541
- 542 Becker, P. (1999). Beyond the big five. *Personality and Individual Differences, 26*(3), 511-
543 530.
544
- 545 Bernard, M. M., Maio, G. R., & Olson, J. M. (2003). Effects of introspection about reasons
546 for values: Extending research on values-as-truisms. *Social Cognition, 21*(1), 1-25.
547
- 548 Bilsky, W., Janik, M., & Schwartz, S. H. (2011). The structural organization of human
549 values-evidence from three rounds of the European Social Survey (ESS). *Journal of*
550 *cross-cultural psychology, 42*(5), 759-776.
551
- 552 Bilsky, W., & Schwartz, S. H. (1994). Values and personality. *European journal of*
553 *personality, 8*(3), 163-181.
554
- 555 Boer, D. (2014). SSVS-G. short Schwartz’s value survey-German. *Psychologische und*
556 *sozialwissenschaftliche Kurzskaalen, 299-302*.
557
- 558 Boer, D. (2017). Values and affective well-being: How culture and environmental threat
559 influence their association. In *Values and Behavior* (pp. 191-218). Springer.
560
- 561 Boer, D., & Fischer, R. (2013). How and when do personal values guide our attitudes and
562 sociality? Explaining cross-cultural variability in attitude–value linkages.
563 *Psychological bulletin, 139*(5), 1113.
564
- 565 Boer, D., Fischer, R., Strack, M., Bond, M. H., Lo, E., & Lam, J. (2011). How shared
566 preferences in music create bonds between people: Values as the missing link.
567 *Personality and social psychology bulletin, 37*(9), 1159-1171.
568
- 569 Bullivant, S. (2018). Europe’s young adults and religion: Findings from the European Social
570 Survey (2014-16) to inform the 2018 Synod of Bishops.

- 571
572 Byrd, R. H., Lu, P., Nocedal, J., & Zhu, C. (1995). A limited memory algorithm for bound
573 constrained optimization. *SIAM Journal on scientific computing*, *16*(5), 1190-1208.
574
- 575 Carter, N. T., Guan, L., Maples, J. L., Williamson, R. L., & Miller, J. D. (2016). The
576 downsides of extreme conscientiousness for psychological well-being: The role of
577 obsessive compulsive tendencies. *Journal of personality*, *84*(4), 510-522.
578
- 579 Carver, C. S., & White, T. L. (1994). Behavioral inhibition, behavioral activation, and
580 affective responses to impending reward and punishment: the BIS/BAS scales.
581 *Journal of personality and social psychology*, *67*(2), 319.
582
- 583 Çileli, M. (2000). Change in value orientations of Turkish youth from 1989 to 1995. *The*
584 *Journal of Psychology*, *134*(3), 297-305.
585
- 586 De Raad, B., Barelds, D. P., Mlačić, B., Church, A. T., Katigbak, M. S., Ostendorf, F.,
587 Hřebíčková, M., Di Blas, L., & Szirmák, Z. (2010). Only three personality factors are
588 fully replicable across languages: Reply to Ashton and Lee. *Journal of research in*
589 *personality*, *44*(4), 442-445.
590
- 591 Emmons, R. A., & Diener, E. (1986). Influence of impulsivity and sociability on subjective
592 well-being. *Journal of personality and social psychology*, *50*(6), 1211.
593
- 594 Fischer, R. (2017). *Personality, values, culture: An evolutionary approach*. Cambridge
595 University Press.
596
- 597 Fumero, A., Marrero, R. J., & Fonseca-Pedrero, E. (2018). Well-being in schizotypy: the
598 effect of subclinical psychotic experiences. *Psicothema*, *30*(2), 177-182.
599
- 600 Furnham, A., Richards, S. C., & Paulhus, D. L. (2013). The Dark Triad of personality: A 10
601 year review. *Social and Personality Psychology Compass*, *7*(3), 199-216.
602
- 603 Gale, C. R., Booth, T., Möttus, R., Kuh, D., & Deary, I. J. (2013). Neuroticism and
604 Extraversion in youth predict mental wellbeing and life satisfaction 40 years later.
605 *Journal of research in personality*, *47*(6), 687-697.
606
- 607 Goldberg, L. R. (1992). The development of markers for the Big-Five factor structure.
608 *Psychological assessment*, *4*(1), 26.
609
- 610 Góngora, V. C., & Castro Solano, A. (2017). Pathological personality traits (DSM-5), risk
611 factors, and mental health. *Sage Open*, *7*(3), 2158244017725129.
612
- 613 Hanel, P. (2016). *Human values and value instantiations: Similarities and differences*
614 *between countries and their implications* [Cardiff University].
615
- 616 Hanel, P. H., Demmrich, S., & Wolfradt, U. (2019). Centrality of Religiosity, Schizotypy,
617 and Human Values: The Impact of Religious Affiliation. *Religions*, *10*(5), 297.
618

- 619 Hanel, P. H., & Wolfradt, U. (2016). The ‘dark side’ of personal values: Relations to clinical
620 constructs and their implications. *Personality and Individual Differences*, *97*, 140-
621 145.
- 622
- 623 Hanel, P. H., Zacharopoulos, G., Mégardon, G., & Maio, G. R. (2017). Detecting sinusoidal
624 patterns from circumplex models of psychological constructs.
625 <https://psyarxiv.com/wh92k/>
626
- 627 Haslam, N., Whelan, J., & Bastian, B. (2009). Big Five traits mediate associations between
628 values and subjective well-being. *Personality and Individual Differences*, *46*(1), 40-
629 42.
- 630
- 631 Hofstede, G. (2001). *Culture's consequences: Comparing values, behaviors, institutions and*
632 *organizations across nations*. Sage publications.
- 633
- 634 Inglehart, R. (1997). Modernization, postmodernization and changing perceptions of risk.
635 *International Review of Sociology*, *7*(3), 449-459.
- 636
- 637 Jonason, P. K., Strosser, G. L., Kroll, C. H., Duineveld, J. J., & Baruffi, S. A. (2015). Valuing
638 myself over others: The Dark Triad traits and moral and social values. *Personality*
639 *and Individual Differences*, *81*, 102-106.
- 640
- 641 Kajonius, P. J., Persson, B. N., & Jonason, P. K. (2015). Hedonism, achievement, and power:
642 Universal values that characterize the dark triad. *Personality and Individual*
643 *Differences*, *77*, 173-178.
- 644
- 645 Kasser, T. (2002). Sketches for a self-determination theory of values. *Handbook of self-*
646 *determination research*, *123*, 40.
- 647
- 648 Kasser, T., & Ryan, R. M. (1993). A dark side of the American dream: Correlates of financial
649 success as a central life aspiration. *Journal of personality and social psychology*,
650 *65*(2), 410.
- 651
- 652 Klages, H. (2005). Modernization and value change. *Culture and human development: The*
653 *importance of cross-cultural research for the social sciences*, 273-288.
- 654
- 655 Lee, K., & Ashton, M. C. (2004). Psychometric properties of the HEXACO personality
656 inventory. *Multivariate behavioral research*, *39*(2), 329-358.
- 657
- 658 Lindeman, M., & Verkasalo, M. (2005). Measuring values with the short Schwartz's value
659 survey. *Journal of personality assessment*, *85*(2), 170-178.
- 660
- 661 Maio, G. R. (2016). *The psychology of human values*. Psychology press.
- 662
- 663 Maio, G. R., Pakizeh, A., Cheung, W.-Y., & Rees, K. J. (2009). Changing, priming, and
664 acting on values: effects via motivational relations in a circular model. *Journal of*
665 *personality and social psychology*, *97*(4), 699.
- 666
- 667 Manfredó, M. J., Bruskotter, J. T., Teel, T. L., Fulton, D., Schwartz, S. H., Arlinghaus, R.,
668 Oishi, S., Uskul, A. K., Redford, K., & Kitayama, S. (2017). Why social values

- 669 cannot be changed for the sake of conservation. *Conservation Biology*, 31(4), 772-
670 780.
- 671
- 672 Nash, J. C. (1990). *Compact numerical methods for computers: linear algebra and function*
673 *minimisation*. CRC press.
- 674
- 675 Nelder, J. A., & Mead, R. (1965). A simplex method for function minimization. *The*
676 *computer journal*, 7(4), 308-313.
- 677
- 678 Oishi, S., Diener, E., Lucas, R. E., & Suh, E. M. (2009). Cross-cultural variations in
679 predictors of life satisfaction: Perspectives from needs and values. In *Culture and*
680 *well-being* (pp. 109-127). Springer.
- 681
- 682 Paulhus, D. L., & Williams, K. M. (2002). The dark triad of personality: Narcissism,
683 Machiavellianism, and psychopathy. *Journal of research in personality*, 36(6), 556-
684 563.
- 685
- 686 Pavot, W., Diener, E., & Fujita, F. (1990). Extraversion and happiness. *Personality and*
687 *Individual Differences*, 11(12), 1299-1306.
- 688
- 689 Raine, A. (1991). The SPQ: a scale for the assessment of schizotypal personality based on
690 DSM-III-R criteria. *Schizophrenia bulletin*, 17(4), 555-564.
- 691
- 692 Roccas, S., & Sagiv, L. (2017). *Values and behavior: Taking a cross cultural perspective*.
693 Springer.
- 694
- 695 Roccas, S., Sagiv, L., Schwartz, S. H., & Knafo, A. (2002). The big five personality factors
696 and personal values. *Personality and social psychology bulletin*, 28(6), 789-801.
- 697
- 698 Rokeach, M. (1973). *The nature of human values*. Free press.
- 699
- 700 Rokeach, M. (1975). Long-term value changes initiated by computer feedback. *Journal of*
701 *personality and social psychology*, 32(3), 467.
- 702
- 703 Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic
704 motivation, social development, and well-being. *American psychologist*, 55(1), 68.
- 705
- 706 Sagiv, L., Roccas, S., & Hazan, O. (2004). Value pathways to well-being: Healthy values,
707 valued goal attainment, and environmental congruence. *Positive psychology in*
708 *practice*, 68-85.
- 709
- 710 Sagiv, L., & Schwartz, S. H. (2000). Value priorities and subjective well-being: Direct
711 relations and congruity effects. *European journal of social psychology*, 30(2), 177-
712 198.
- 713
- 714 Saroglou, V., Delpierre, V., & Dernelle, R. (2004). Values and religiosity: A meta-analysis of
715 studies using Schwartz's model. *Personality and Individual Differences*, 37(4), 721-
716 734.
- 717

- 718 Schermer, J. A., Feather, N., Zhu, G., & Martin, N. G. (2008). Phenotypic, genetic, and
 719 environmental properties of the portrait values questionnaire. *Twin Research and*
 720 *Human Genetics, 11*(5), 531-537.
 721
- 722 Schermer, J. A., Vernon, P. A., Maio, G. R., & Jang, K. L. (2011). A behavior genetic study
 723 of the connection between social values and personality. *Twin Research and Human*
 724 *Genetics, 14*(3), 233-239.
 725
- 726 Schwartz, S. H. (1992). Universals in the content and structure of values: Theoretical
 727 advances and empirical tests in 20 countries. *Advances in experimental social*
 728 *psychology, 25*(1), 1-65.
 729
- 730 Schwartz, S. H. (2003). Instructions for computing scores for the 10 human values and using
 731 them in analyses. *Documentation for ESS-1*.
 732
- 733 Schwartz, S. H., Cieciuch, J., Vecchione, M., Davidov, E., Fischer, R., Beierlein, C., Ramos,
 734 A., Verkasalo, M., Lönnqvist, J.-E., & Demirutku, K. (2012). Refining the theory of
 735 basic individual values. *Journal of personality and social psychology, 103*(4), 663.
 736
- 737 Schwartz, S. H., & Sortheix, F. (2018). Values and subjective well-being. *Handbook of well-*
 738 *being*.
 739
- 740 Sheldon, K. M. (2005). Positive value change during college: Normative trends and
 741 individual differences. *Journal of research in personality, 39*(2), 209-223.
 742
- 743 Thalmayer, A. G., Saucier, G., & Eigenhuis, A. (2011). Comparative validity of brief to
 744 medium-length Big Five and Big Six personality questionnaires. *Psychological*
 745 *assessment, 23*(4), 995.
 746
- 747 Thordarson, D. S., Radomsky, A. S., Rachman, S., Shafran, R., Sawchuk, C. N., & Hakstian,
 748 A. R. (2004). The Vancouver obsessional compulsive inventory (VOCI). *Behaviour*
 749 *research and therapy, 42*(11), 1289-1314.
 750
- 751 UNDP. (2015). Human Development Report 2015: Work for Human Development. New
 752 York. <http://hdr.undp.org/en/content/human-development-report-2015>
 753
- 754 Van Os, J., Park, S., & Jones, P. B. (2001). Neuroticism, life events and mental health:
 755 evidence for person-environment correlation. *The British Journal of Psychiatry,*
 756 *178*(S40), s72-s77.
 757
- 758 Verkasalo, M., Goodwin, R., & Bezmenova, I. (2006). Values following a major terrorist
 759 incident: Finnish adolescent and student values before and after September 11, 2001.
 760 *Journal of Applied Social Psychology, 36*(1), 144-160.
 761
- 762 Whiteside, S. P., & Lynam, D. R. (2001). The five factor model and impulsivity: Using a
 763 structural model of personality to understand impulsivity. *Personality and Individual*
 764 *Differences, 30*(4), 669-689.
 765

- 766 Zacharopoulos, G., Hanel, P. H., Lancaster, T. M., Ihssen, N., Drakesmith, M., Foley, S.,
767 Maio, G. R., & Linden, D. E. (2017). Nonlinear associations between human values
768 and neuroanatomy. *Social neuroscience*, *12*(6), 673-684.
769
- 770 Zacharopoulos, G., Lancaster, T., Bracht, T., Ihssen, N., Maio, G. R., & Linden, D. E. (2016).
771 A hedonism hub in the human brain. *Cerebral Cortex*, *26*(10), 3921-3927.
772
- 773 Zacharopoulos, G., Lancaster, T. M., Maio, G. R., & Linden, D. E. (2016). The genetics of
774 neuroticism and human values. *Genes, Brain and Behavior*, *15*(4), 361-366.
775
776