



A cross-cultural comparison between Spain and the USA: Temperament and character distribution by sex and age

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ABSTRACT

The Unified Biosocial Theory of Personality developed by Cloninger has been applied in different cultures. Distribution by age and sex of the Temperament and Character Inventory (TCI) dimensions were assessed cross-culturally for samples in Spain and the USA. Three non-clinical samples were included: i) 404 participants from Asturias (Spain); ii) 240 participants from Burgos (Spain); and iii) 300 adults from St. Louis (USA). Each participant was assessed by means of the TCI. A significant negative correlation between NS and both HA ($r = -0.329$; $P < 0.01$) and P ($r = -0.217$; $P < 0.01$) was found in the study sample, as well as significant effects of age in NS, HA, RD, and C for women and in NS and HA for men, and also of sex in HA and RD. Personality dimensions for the two Spanish samples appear to be similar (differences in HA4 and RD) compared to those for the US sample (differences in NS, HA, RD and P). Findings support Cloninger's theory about differences between men and women, but not regarding the intercorrelations between temperament dimensions.

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1. Introduction

The study of personality is a field which has had to deal with numerous problems of concept and definition. Cloninger et al. (1993) formulated the Unified Biosocial Theory of Personality, which postulates that personality is structured around four primary temperament dimension – Novelty Seeking (NS), Harm Avoidance (HA), Reward Dependence (RD) and Persistence (P) – and three character dimensions – Self-directedness (SD), Cooperation (C) and Self-transcendence (ST). To measure these dimensions, Cloninger et al. (1994) developed the Temperament and Character Inventory (TCI).

The model has been applied in a variety of different cultures. Previous cross-cultural studies on Cloninger's scales have included samples from two or three countries using *t*-test comparison (Svrakic et al., 1991; Richter et al., 1999; Pélissolo and Lépine, 2000; Brändström et al., 2001; Dzamonja-Ignjatovic et al., 2010). The study by Brändström et al. (2001) was performed using three samples from Sweden, Germany, and the USA, which were individually matched for age-cohort and sex, and were representative of the normal population. The main finding was that

European samples appear highly comparable in score distributions for all dimensions – explained by the fact that the two European countries considered are in the same cultural region (Brändström et al., 2001). Another study by Richter et al. (2004) consisted in a cross-cultural comparison by means of ANOVA and *t*-test of personality traits between individuals from two very different cultures (Sweden and Iran) and refugees from one culture who had resettled several years earlier in the other (Iranians in Sweden). The differences between the Swedish and Iranian individuals were greater than those found between the Swedes and the refugees. (Richter et al., 2004).

As far as meta-analytic studies are concerned, Miettunen et al. (2006, 2007, 2008) have carried out three. The aim of the first study was to compare Cloninger's temperament dimensions across 20 countries. The main finding was that there were few major differences in the mean scores on Cloninger's temperament scales between the different countries. The means of HA and NS varied very little, and in that of P, the US sample scored higher than those from the other countries; the Japanese sample differed significantly in RD (Miettunen et al., 2006). In the second meta-analysis, the objectives were to estimate sex differences in temperament dimensions and study the effect of mean age of the sample and location of the study (Asia/other) on possible differences. It can be concluded that women scored consistently higher in HA and RD (Miettunen et al., 2007). Finally, the objective of the third study was to obtain estimates for the magnitude

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of the correlations between Cloninger's temperament dimensions. The principal finding was a moderate negative correlation between NS and HA (Miettunen et al., 2008).

However, neither of these meta-analyses considered studies carried out with Spanish samples. Thus, the objectives of the present research are: i) to study distribution by sex and age of the TCI dimensions in a healthy Spanish sample; ii) to analyze Cloninger's model from a cross-cultural perspective with samples from Spain and the USA, in the same line as the study by Brändström et al. (2001), comparing the TCI mean scores of the sample recruited in the present study with one from the same cultural area [using a Spanish sample from a previous report (Mateos Agut and De la Gándara, 2001)] and also using for comparison the US sample from the original study by Cloninger et al. (1993); iii) to study the inter-correlation between Cloninger's temperament dimension and the meta-analysis results from 20 countries from Miettunen et al. (2008).

2. Method

2.1. Participants

The present study sample comprised 404 unrelated healthy subjects of Spanish Caucasian origin, resident in the region of Asturias (north-western Spain) and aged 20–60 years, with an average age of 40.96 ± 11.47 years for men and 40.10 ± 11.02 for women (50% males). Half (50.5%) of the men had attained a level of education beyond secondary, while the corresponding figure for women was 61.9%. Almost one in four men was either retired (10.9%) or unable to work (12.9%), compared to just 3% of the women. Homemakers accounted for 12.4% of the women and just 1% of the men. A higher proportion of women worked in public administration (36.6% vs. 21.3%), whereas farming/fishing/mining/building and other industries were predominantly male employment sectors (27.7% vs. 2.0%). As regards marital status, in both men and women, about 32% of the sample was single and roughly 53% were married.

These individuals were consecutively selected and evaluated by the same general practitioner after seeking medical care for an acute, non-serious medical event (e.g., cold, otitis, lumbago). Only those with no history of drug or alcohol abuse or dependence, without psychiatric disorder data in their clinical records, and without a personal or first-degree family history of psychiatric disorders were invited to take part, and participation was wholly voluntary and unrewarded. These criteria were intended to ensure that participants were really healthy. It is known that personality traits may be affected by various disorders, and given the heritability of some of them, we decided to establish as an exclusion criterion from the study those who had first-degree relatives affected by a mental disorder. Patients filled out the TCI in an office at the health centre. The Spanish version of the Mini-International Neuropsychiatric Interview (MINI, DSM-IV criteria) was used as a psychiatric screening interview – Axis I (Sheehan et al., 1997), and was applied by the general practitioner (previously trained for this purpose). Initially, 540 patients (by strict order of appearance during the field phase) were selected, of whom 66 (12.2%) were ruled out due to positive results in the MINI, while another 70 (12.9%) declined to participate.

The characteristics of the comparison samples were as follows: the Spanish sample comprised 240 healthy subjects aged 18–76 years from the region of Burgos (north-central Spain), balanced in accordance with the general Spanish population with regard to age and sex distribution (50% males), with an average age of 34.7 years for women and 34.6 for men. Mean age of the total sample was 34.65 ± 14.36 years. The sample was obtained from among the family members, supposedly healthy, of staff at a hospital in Burgos. All agreed to participate voluntarily (Mateos Agut and De la Gándara, 2001). The US normative data are based on a study of a community sample of 300 adults from the city of St. Louis (mid-USA). Participation in the study was requested as they entered a shopping mall whose customers were thought to be fairly representative of the general population of St. Louis. Participants, all aged 18 or over, were recruited sequentially, and were excluded only if they were in an oversampled gender-age group. Mean (\pm S.D.) age of the sample was 34.1 ± 12.9 years (range, 18 to 91 years). The women (35.5 ± 13.7 years) were slightly older than the men (32.7 ± 11.9 years) (Cloninger et al., 1993).

2.2. Procedure

Each participant completed the most commonly used version of the TCI (version 9), which assesses the personality traits of Cloninger's model by means of 240 true/false items. The TCI measures four temperament dimensions: novelty seeking (NS) – a heritable tendency to excitement in response to novelty; harm avoidance (HA) – a heritable tendency to inhibit behaviours for avoiding novelty and punishment; reward dependence (RD) – a heritable tendency to maintain response to reward signals; and persistence (P) – a heritable tendency to persevere despite frustration and fatigue. There are three character dimensions: self-directedness (SD) – the self-determination and ability to regulate behaviour to suit one's own goals and values; cooperativeness (C) – the identification with and acceptance of others; and self-transcendence (ST) – the identification with some form of spirituality (Tse and Bond, 2007). The descriptors

for low and high scores on TCI subscales are shown in Table 1 (adapted from Dzamonja-Ignjatovic et al., 2010).

2.3. Statistical analysis

Pearson's correlation coefficient was used to assess the linear association between temperament dimensions in the sample obtained in the present study. Gender and age differences relating to the TCI measures were assessed using *t*-tests. Bonferroni correction was used and statistical significance was set at a level of $P = 0.0016$. For studying differences according to age, the sample was stratified in the following groups: 21–30 years, 31–40 years, 41–50 years, and 51–60 years. Differences between the two Spanish samples and between the Spanish sample and the US sample were also assessed using *t*-tests. SPSS version 15.0 (SPSS Inc., Chicago, Illinois, USA) was used for the statistical analyses.

3. Results

3.1. Intercorrelation between temperament dimensions

Table 2 shows the correlations between NS, HA, RD and P, respectively, and in comparison to the meta-analysis results from 20 countries (Miettunen et al., 2008). There was a significant negative correlation between NS and both HA and P. The negative correlation between HA and P is weaker in Spain than internationally.

3.2. TCI dimensions by sex and age

The mean scores and standard deviations for the sample by sex on the TCI scales and subscales are shown in Table 3. Significant differences were found according to sex in the dimensions HA [$t = -2.46$, $P = 0.014$] and RD [$t = -3.17$, $P = 0.002$], as well as on three temperament subscales [HA1: $t = -2.05$, $P = 0.041$; HA2: $t = -4.76$, $P < 0.001$; and RD1: $t = -3.94$, $P < 0.001$] and on two character subscales [C5: $t = 2.6$, $P = 0.010$; ST3: $t = -2.81$, $P = 0.005$].

Table 1
Description of TCI subscales.

Personality traits	High score	Low score
<i>Temperament</i>		
Novelty seeking (NS)		
NS1: exploratory excitability	Exploratory	Reserved
NS2: impulsiveness	Impulsive	Deliberate
NS3: extravagance	Extravagant	Thrifty
NS4: disorderliness	Irritable	Stoical
Harm Avoidance (HA)		
HA1: worry and pessimism	Pessimistic	Optimistic
HA2: fear of uncertainty	Fearful	Daring
HA3: shyness	Shy	Outgoing
HA4: fatigability	Fatigable	Energetic
Reward dependence (RD)		
RD1: sentimentality	Sentimental	Detached
RD3: attachment	Warm	Cold
RD4: dependence	Appreciative	Independent
Persistence (P)	Determined	Spoiled
<i>Character</i>		
Self-directedness (SD)		
SD1: responsibility	Responsible	Blaming
SD2: purposefulness	Purposeful	Aimless
SD3: resourcefulness	Resourceful	Inept
SD4: self-acceptance	Self-accepted	Vain
SD5: congruent second nature	Disciplined	Undisciplined
Cooperativeness (CO)		
C1: social acceptance	Tenderhearted	Intolerant
C2: empathy	Empathic	Insensitive
C3: helpfulness	Helpful	Hostile
C4: compassion	Compassionate	Revengeful
C5: pure hearted	Principled	Opportunistic
Self-transcendence (ST)		
ST1: self-forgetful	Intuitive	Contrived
ST2: transpersonal identification	Acquiescent	Controlling
ST3: spiritual acceptance	Spiritual	Materialistic

Adapted from Dzamonja-Ignjatovic et al., 2010.

Table 2
Intercorrelation between temperament dimensions in Spain and internationally.

	Novelty Seeking	Harm Avoidance	Reward Dependence	Persistence
Novelty Seeking				
<i>r</i>		−0.33*	0.09	−0.22*
^a Min/max	1	−0.45/−0.08	−0.08/0.45	−0.29/0.06
^a Mean		−0.27	0.10	−0.14
Harm Avoidance				
<i>r</i>			0.01	−0.06
^a Min/max		1	−0.17/0.25	−0.30/−0.09
^a Mean			0.04	−0.20
Reward Dependence				
<i>r</i>				0.8
^a Min/max			1	−0.24/0.13
^a Mean				0.05

**P*<0.001.

^aMiettunen et al. (2008).

As regards age, Tables 4 and 5 show the statistically significant differences between mean scores for the samples of women and men, respectively, by age group. Thus, in the women such differences were found in three of the four temperament dimensions (NS, HA and RD) and in the C character dimension, as well as in the subscales SD2, SD3

Table 3
Distribution and comparison of the TCI scales and subscales by sex.

	Male (<i>n</i> =202)	Female (<i>n</i> =202)	All (<i>n</i> =404)
	Mean (S.D.)	Mean (S.D.)	Mean (S.D.)
Temperament			
Novelty Seeking	17.68 (5.64)	17.66 (5.83)	17.67 (5.73)
– NS1 [exploratory excitability]	5.82 (5.64)	5.86 (2.39)	5.84 (2.38)
– NS2 [impulsiveness]	3.40 (2.24)	3.56 (2.22)	3.48 (2.24)
– NS3 [extravagance]	4.73 (1.99)	4.71 (2.06)	4.72 (2.03)
– NS4 [disorderliness]	3.72 (1.84)	3.53 (2.02)	3.63 (1.93)
Harm Avoidance	15.47 (6.05)*	17.0 (6.44)*	16.24 (6.29)
– HA1 [anticipatory worry]	4.27 (2.58)*	4.80 (2.60)*	4.54 (2.60)
– HA2 [fear of uncertainty]	4.20 (1.89)***	5.06 (1.74)***	4.63 (3.97)
– HA3 [shyness with strangers]	3.86 (2.01)	4.09 (2.16)	3.97 (2.09)
– HA4 [fatigability and asthenia]	3.14 (1.90)	3.05 (2.12)	3.1 (2.01)
Reward Dependence	15.87 (3.96)**	17.06 (3.58)**	16.47 (3.82)
– RD1 [sentimentality]	6.72 (2.12)***	7.48 (1.74)***	7.1 (1.98)
– RD3 [attachment]	5.30 (2.24)	5.70 (2.04)	5.5 (2.15)
– RD4 [dependence]	3.85 (1.37)	3.89 (1.45)	3.87 (1.41)
Persistence	4.53 (1.98)	4.67 (1.96)	4.6 (1.97)
Character			
Self-Directedness	31.0(6.95)	30.2 (7.11)	30.6 (7.04)
– SD1 [responsibility]	5.85 (1.83)	5.78 (2.04)	5.81 (1.93)
– SD2 [purposefulness]	5.72 (1.79)	5.65 (1.94)	5.69 (1.87)
– SD3 [resourcefulness]	3.32 (1.48)	3.06 (1.42)	3.19 (1.46)
– SD4 [self-acceptance]	7.62 (2.85)	7.36 (2.59)	7.5 (2.72)
– SD5 [congruent second nature]	8.49 (2.27)	8.34 (2.46)	8.42 (2.37)
Cooperation	32.07 (5.49)	33.1 (5.02)	32.59 (5.28)
– C1 [social acceptance]	6.68 (1.52)	6.81 (1.37)	6.74 (1.45)
– C2 [empathy]	4.94 (1.49)	5.14 (1.36)	5.04 (1.46)
– C3 [helpfulness]	6.24 (1.22)	6.15 (1.33)	6.20 (1.28)
– C4 [compassion]	7.54 (2.33)	7.95 (2.02)	7.75 (2.19)
– C5 [integrated conscience]	6.67 (1.67)*	7.06 (1.33)*	6.87 (1.51)
Self-Transcendence	12.9 (5.5)	13.3 (6.0)	13.1 (5.7)
– ST1 [self-forgetfulness]	5.24 (2.58)	5.22 (2.54)	5.23 (2.56)
– ST2 [transpersonal identity]	3.65 (2.28)	3.37 (2.09)	3.51 (2.19)
– ST3 [spiritual acceptance]	3.98 (2.58)**	4.47 (2.86)**	4.36 (2.75)

P*<0.05; *P*< 0.01; ****P*< 0.001.

S.D. = standard deviation.

Table 4
Age differences in TCI dimensions for women.

	Age groups (<i>n</i>)				<i>F</i> ^a	Post hoc differences
	21–30 (53)	31–40 (50)	41–50 (50)	51–60 (49)		
	Mean (S.D.)	Mean (S.D.)	Mean (S.D.)	Mean (S.D.)		
Temperament						
NS	19.3 (5.1)	18 (6.2)	18 (6.2)	15 (4.9)	5.21***	51–60<21–50
HA	15.5 (6.2)	16.8 (6.5)	16.3 (6.6)	19.3 (5.8)	3.31**	51–60>21–50
RD	18.3 (3.1)	17.3 (3.3)	16.1 (3.4)	16.3 (3.5)	4.28**	21–30>41–60
Character						
C	35.5 (3.5)	32.7 (5.4)	32.4 (4.6)	31.6 (5.5)	6.56***	21–30>31–60
SD2	6.3 (1.5)	5.3 (2.2)	5.7 (1.8)	5.1 (1.9)	3.82*	51–60<21–30
SD3	3.4 (1.3)	3.1 (1.3)	3.1 (1.3)	2.4 (1.5)	4.51**	51–60<21–50
ST2	2.9 (2.1)	2.9 (1.8)	3.2 (2)	4.3 (2)	5.55***	51–60>21–50

P*<0.05; *P*< 0.01; ****P*< 0.001

S.D. = standard deviation.

C = cooperation; HA = harm avoidance; NS = novelty seeking; RD = reward dependence; SD2 = purposefulness; SD3 = resourcefulness; ST2 = transpersonal identity.

^a Anova post hoc Duncan.

and ST2. In the men, statistically significant differences emerge in two temperament dimensions (NS and HA) and in the subscale RD3, as well as in the character subscales C2, C3 and ST2.

3.3. Cross-cultural comparison between Spain and the USA

3.3.1. Differences in TCI dimensions by Spanish region

No statistically significant differences were observed in any of the global dimensions, though differences were indeed observed in both subscales HA4 (temperament) and C3 (character) (Table 6). The distributions of the TCI temperament and character dimensions were normal, with non-normal distributions only in some subscales, such as HA2, RD3, S1, SD2 and C1.

3.3.2. Differences in TCI dimensions by country

The comparisons between mean scores obtained in the total sample from the present study and those obtained by the population studied by Cloninger et al. (1993) yielded statistically significant differences in all the temperament dimensions (NS, HA, RD and P), as well as in several of the subscales of those dimensions (Table 7). Participants in the US sample scored higher in NS and P, while those in

Table 5
Age differences in TCI dimensions for men.

	Age groups (<i>n</i>)				<i>F</i> ^a	Post hoc differences
	21–30 (49)	31–40 (52)	41–50 (50)	51–60 (51)		
	Mean (S.D.)	Mean (S.D.)	Mean (S.D.)	Mean (S.D.)		
Temperament						
NS	20.3 (5.9)	18.2 (5.2)	16.9 (4.6)	15.3 (5.7)	7.73***	41–50<21–30 51–60<21–40
HA	13.1 (6.4)	15.9 (6.5)	15 (5.2)	17.2 (5.2)	4.10**	21–30<31–60
RD3	6 (2.1)	4.9 (2.3)	5.4 (2)	4.8 (2.2)	3.34*	21–30>31–50
Character						
C1	6.9 (1.4)	6.9 (1.5)	6.7 (1.1)	6.1 (1.8)	3.16*	51–60<21–40
C2	5.5 (1.3)	5 (1.4)	4.9 (1.5)	4.2 (1.4)	6.25***	51–60<21–50
ST2	2.7 (2)	3.3 (2.2)	3.7 (2.4)	4.7 (2)	7.65***	51–60>21–50 21–30<41–50

P*<0.05; *P*< 0.01; ****P*< 0.001.

S.D. = standard deviation.

C1 = social acceptance; C2 = empathy; HA = harm avoidance; NS = novelty seeking; RD3 = attachment; ST2 = transpersonal identity.

^a Anova post hoc Duncan.

Table 6
Differences in TCI dimensions by Spanish region.

	Asturias	Burgos	t
	Mean (S.D.)	Mean (S.D.)	
<i>Temperament</i>			
HA4	3.1 (2)	3.8 (2)	−4.28*
<i>Character</i>			
C3	6.2 (1.2)	5.5 (1.5)	6.29*

* $P < 0.001$.

C3 = helpfulness; HA4 = fatigability and asthenia.

the Spanish sample scored higher in HA and RD. With regard to Character, significant differences were found in the ST dimension, in which the St. Louis sample scored higher, and in the majority of SD subscales (SD3, SD4, SD5).

4. Discussion

The present study explores TCI scores distribution by sex and age in a Spanish sample. While it is indeed true that normative samples include subjects with psychiatric disorder, this study was carried out with non-clinical population in order to guarantee that participants were really healthy and thus ensure compatibility with the previously-cited meta-analyses (Miettunen et al., 2006, 2007, 2008). This was the reason why individuals with first-degree relatives affected by mental disorders were excluded. The importance of genetic vulnerability or inheritability in most mental disorders is well known. Thus, by eliminating those with first-degree relatives the selection of the sample becomes more rigorous, especially in the youngest individuals, who are still within the age range at risk of suffering the first symptoms of such disorders.

Regarding the intercorrelation between temperament dimensions, we found a negative and statistically significant correlation between NS and HA, as postulated in the Cloninger et al. (1993) model, but not between NS and RD (Cloninger et al., 1993). Also, if we compare our

Table 7
Differences in TCI dimensions by country.

	Spain (Asturias)	USA (St. Louis)	t
	Mean (S.D.)	Mean (S.D.)	
<i>Temperament</i>			
NS	17.6 (5.7)	19.2 (6)	−3.43*
NS4	3.6 (1.9)	4.3 (2.1)	−4.39*
HA	16.2 (6.3)	12.6 (6.8)	7.33*
HA1	4.5 (2.6)	3.2 (2.4)	6.99*
HA2	4.6 (3.9)	3.6 (2)	4.12*
HA3	3.9 (2.1)	3.3 (2.3)	4.03*
HA4	3.10 (2)	2.5 (2.2)	3.76*
RD	16.4 (3.8)	15.50 (4.4)	3.12*
RD3	5.5 (2.1)	4.7 (2.3)	4.74*
RD4	3.8 (1.4)	3.5 (1.6)	3.25*
P	4.6 (1.9)	5.6 (1.9)	−6.76*
<i>Character</i>			
SD3	3.1 (1.4)	4 (1.2)	−7.84*
SD4	7.5 (2.7)	6.4 (2.8)	5.19*
SD5	8.4 (2.3)	9 (2.5)	−3.14*
ST	13.1 (5.7)	19.2 (6.3)	−13.42*
ST1	5.2 (2.5)	5.9 (2.7)	−3.35*
ST2	3.5 (2.2)	4.6 (2.4)	−6.27*
ST3	4.3 (2.7)	8.70 (2.9)	−20.23*

* $P < 0.001$.

HA = harm avoidance; HA1 = anticipatory worry; HA2 = fear of uncertainty; HA3 = shyness with strangers; HA4 = fatigability and asthenia; NS = novelty seeking; NS4 = disorderliness; P = persistence; RD = reward dependence; RD3 = attachment; RD4 = dependence; SD3 = resourcefulness; SD4 = self-acceptance; SD5 = congruent second nature; ST = self-transcendence; ST1 = self-forgetfulness; ST2 = transpersonal identity; ST3 = spiritual acceptance.

correlation coefficients with those of Miettunen et al.'s (2008) meta-analysis, we find that such coefficients are within the range described by those authors, except in the case of the correlation between HA and P, whose coefficient is clearly lower. It should perhaps be noted here that Cloninger recently developed a revised version of the TCI (TCI-R) (Cloninger et al., 1999), in which the P and RD dimensions were changed to improve their description and measurement. However, this revised version has not been widely used.

Regarding the TCI dimension by sex, we observed significant differences in the HA and RD dimensions, in accordance with previous reports (Cloninger et al., 1993; Mendlowicz et al., 2000; Parker et al., 2003; Miettunen et al., 2007). Women showed greater behavioural inhibition and worry than men, as well as greater sentimentalism, empathy and intensity in reward-dependent responses. Such traits would fit with the macrosocial characteristics of Western culture as regards the distinction of sexual roles. As regards the mean values of the meta-analysis carried out by Miettunen et al. (2006), Asturias is close to the mean scores for Belgium in the NS and HA dimensions, close to Italy in the RD dimension and similar to France in P. Likewise, significant differences were observed in the temperament dimensions according to age in the direction found by Brändström et al. (2001) – scores increase in HA and ST as well as decreasing in NS.

With regard to cross-cultural study, if we compare the scores obtained in the sample recruited in the present study with those obtained by Cloninger et al. (1993) and by Mateos Agut and De la Gándara (2001), we find that the mean scores obtained in Asturias are unequivocally much more similar to those obtained in Burgos (Mateos Agut and De la Gándara, 2001) than those for the population of St. Louis in the United States (Cloninger et al., 1993). Also, Brändström et al. (2001) and Miettunen et al. (2006) found similarities in temperament profiles between neighboring areas, e.g. Finland and Sweden (Miettunen et al., 2006). In this regard, analysis of the comparison we carried out requires taking into account that there are at least four groups of variables in which the two Spanish samples are more similar to one another than they are to the USA sample: (1) genetic proximity of the populations, (2) cultural and environmental aspects of the individuals of each country, (3) the point in time at which the assessments were made, and (4) the data-gathering contexts. In any case, the characteristics of the study design and differences in the original samples – especially mean age – may have affected the results. In this regard, research has shown that language differences are an important threat to the validity of cross-cultural research (Allik and McCrae, 2004). Another limitation of the study was the impossibility of applying an ANCOVA analysis to control confounding factors in the comparisons, since the original datafiles were not available. Furthermore, on lacking the original Burgos and St Louis datafiles we cannot examine the distribution of the dimensions arising from these data; and due to the previously mentioned limitation (impossibility of ANCOVA analyses), we can only carry out *t*-tests. However, is it important to point out that our study is in line with many other TCI studies that used only *t*-tests for comparison between groups, such as Svrakic et al., 1991; Brändström et al., 2001; Richter et al., 2004, or even the recent Dzamonja-Ignjatovic et al., 2010.

Some theoretical reflections can be made with regard to Cloninger's model. Attempts to explain behaviour on the basis of neurophysiological categories overlook the fact that the behaviour of the organism as a whole is an evolutionary characteristic. Therefore, the environment must fulfil a protagonistic role, rather than a secondary one, in any causal theory of personality (Errasti Pérez, 1998). Further refinement of the theoretical frameworks for the understanding of personality and its links to genetic and neurophysiological aspects are necessary.

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