

THE TEMPERAMENT AND CHARACTER INVENTORY REVISED (TCI-R): DESCRIPTIVE AND FACTOR STRUCTURE IN DIFFERENT AGE LEVELS

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Abstract

This study was aimed to evaluate the psychometric properties and the relationship of age with the answers, internal consistency and factorial structure of the TCI-R. The questionnaire was responded by a sample of 928 voluntary subjects (396 males and 532 women), with a mean age of 30 years old. The participants under 30 scored substantially higher in Novelty Seeking, and to a lesser extent in Reward Dependence, while aged subjects scored significant higher in Harm Avoidance, Self-Directiveness and Cooperation. The global coefficients of factorial congruence were higher than 0.90 in all age groups. The goodness-of-fit indexes in the CFA were unsatisfactory for the simple structure models, although improved when considering secondary loadings. Implications for further research with the TCI-R are discussed.

KEY WORDS: *TCI-R, factorial analysis, personality models, confirmatory factor analysis, Personality aging difference.*

Resumen

Este estudio fue diseñado para evaluar algunas propiedades psicométricas del "Inventario de temperamento y carácter-revisado" (TCI-R), como la consistencia interna y la estructura factorial en función de diferentes grupos de edad. El inventario fue contestado por 928 sujetos (396 varones y 532 mujeres), con una edad media de 30 años. Los participantes menores de 30 años puntuaron sustancialmente más alto en Búsqueda de novedad y en menor medida en Dependencia del refuerzo, mientras los sujetos de mayor edad puntuaron significativamente más alto en Evitación del daño, Autodirección y Cooperación. Los coeficientes globales de congruencia factorial fueron superiores a 0,90 en todos los grupos de edad. Los indicadores de bondad de ajuste del análisis factorial confirmatorio fueron insatisfactorios para los modelos de estructura

simple, aunque mejoraron al incluir las cargas secundarias. Se discuten las implicaciones para futuras investigaciones con el TCI-R.

PALABRAS CLAVE: *TCI-R, análisis factorial, modelos de personalidad, análisis factorial confirmatorio, personalidad y diferencias de edad.*

Introduction

The Temperament and Character Inventory Revised (TCI-R) was the last psychometric instrument developed by Cloninger, Svrakic, Bayón, & Przybeck (1999), a revised version of the TCI (Cloninger, Przybeck, Svrakic, & Wetzel, 1994) as a measure for their biosocial personality model based on four temperaments (Novelty Seeking [NS], Harm Avoidance [HA], Reward Dependence [RD], and Persistence [PS]) and three characters (Self-directedness [SD], Cooperativeness [CO], and Self-transcendence [ST]). In this latter form, a 5-point Likert response format was incorporated, and the PS short scales was converted into a dimension with an additional new subscale for RD (RD2; Open to warm). Both versions had 240-items but the TCI-R preserved 189 of the original TCI. Overall, 37-items were also eliminated, and 51-new items were incorporated, including 5 validity items. The factorial structure of the TCI-R was robust and similar to the TCI, with acceptable facet reliability.

In the past 10 years, the TCI-R has been adapted to several languages and cross-cultural contexts with clinical and non-clinical samples. Equivalent mean scores and sex differences have been generally obtained from the general population with the TCI-R across several countries: females tend to score higher in HA, RD, PS, and CO, whereas males tend to score higher in NS (Gutiérrez-Zotes et al., 2004). On the other hand, there have been only a couple of studies assessing age differences. However, the results obtained with the NEO-PI-R have shown that Conscientiousness increases with age, Neuroticism declines with age for women but not for men, Openness shows small declines with age for men and women, and that Extraversion declines for women although does not change for men. Both Neuroticism and Extraversion scores have been shown to be higher for younger women than for younger men, although for both of these traits - and most strikingly for Neuroticism - the apparent sex differences tend to diminish with age (Srivastava, John, Gosling, & Potter, 2003). Similar results have also been reported by Terracciano, McCrae, Brant, & Costa (2005), suggesting several personality changes in adulthood.

Brändström, Sigvardsson, Nylander, and Richter (2008) recently compared ANOVA mean TCI scores in groups of subjects from 13 to over 65 years old. Older subgroups showed lower scores in NS and ST, and higher scores in SD and CO. Moreover, multivariate analyses have shown an age effect in all TCI subscales, although with more robust effects on SD and CO, in terms of significant between-subject differences. In another recent study with the TCI-R, very similar results were also found in the same direction (Preiss, Kucharová, Novák, & Stepánková, 2007).

Most language adaptation studies of the TCI-R, have analyzed its factor structure with exploratory factor analysis (EFA), and principal components analysis (PCA), with acceptable factorial structures and internal reliability outcomes: Sweden (Brändström,

Richter, & Nylander, 2003), France (Pelissolo, Mallet, Baleyte, Cloninger, Allilaire, & Jouvent, 2005), Belgium (Hansenne, Delhez, & Cloninger, 2005), Italy (Fossati et al., 2007), Czech Republic (Preiss et al.) and Spain (Gutiérrez-Zotes et al., 2004). However, only the study from Fosati et al. was performed with additional approaches such as multi-group analysis, procrustes rotation and Monte Carlo validation of fit indices.

Confirmatory factor analyses (CFA) with the NEO-PI-R (Costa & McCrae, 1992) have generally reported an ill fit to data, despite its robust factor structure. A large discrepancy between the EFA and CFA conclusions regarding the validity of the NEO personality inventory has indeed been found in several countries: Germany (Borkenau & Ostendorf, 1990), Philippines (Katigbak, Church, & Akamine, 1996), Norway (Vassend & Skrandal, 1997), United States (Church & Burke, 1994; Parker, Bagby, & Summerfeldt, 1993) and Spain (Aluja, García, García, & Seisdedos, 2005). These studies have always rejected the NEO-PI-R 5-factor simple structure. McCrae, Zonderman, Costa, Bond, & Paunonen (1996) intended to demonstrate that the CFA is not an adequate tool to assess the replicability of the NEO-PI-R simple structure. These results pointed out that models with a higher complexity tend to show an acceptable fit, with no substantial differences between orthogonal and oblique structures. In this line, the better fit of the oblique models would be an artifact of the simplistic CFA models analysed so far. Similar results have been found with the NEO-PI-R (Aluja et al., 2005), the EPQ (Aluja, García, & García, 2003a), and the ZKPQ (Aluja, García, & García, 2003b), suggesting that the low fit to data in the CFA in regard to personality questionnaires would be due to: (a) an excessive number of observed and latent variables, yielding a high chi-square value, (b) high secondary loadings, and c) high correlations between facets.

The TCI-R factor structure has been relatively unexplored from a CFA approach, therefore, it might be interesting to analyze whether there are differences in the instrument factor structure in regard to age because age differences are likely to arise in the TCI-R dimensions scores. In addition, the factorial invariance of this questionnaire may be better approached within the CFA context rather than from EFA, procrustes rotation, and congruence coefficient analyses, because it allows the assessment of models with different constraints in accordance with McCrae et al. (1996). Thus, the general aim of this study was to analyse the psychometric properties of the Spanish version of the TCI-R and assess age differences on the descriptive and on the factorial structure in a non-clinical sample.

The analysis of the TCI-R factor structure has been mostly done independently for both the temperament and character facets, although also including both types of facets under a single factor solution. A recent study on the factor structure of the TCI-R 29 facets reported a relevant overlap between the facets from the Temperament and Character dimensions (Farmer & Goldberg, 2008). For instance, the HA and SD facets loaded into the same factor indicating that the Temperament and Character dimensions were far from being independent. In the present study we did not pretend to replicate this factor structure, therefore, the facets from the Temperament and Character dimensions were factor analyzed independently (Brändström et al., 2003; Fossati et al., 2007; Gutiérrez-Zotes et al., 2004; Hansenne et al., 2005; Pelissolo et al., 2005).

More precisely, the objectives of the present study were: (a) to study mean scores concerning age, and sex in the current sample; (b) to replicate the factor structure of the TCI-R in accordance with the age group in both, the Temperament and Character facets; (c) to analyze the stability and factor congruence regarding age, and (d) to explore the confirmatory factor models of the TCI-R based in several modified models.

Method

Subjects

Participants were 928 voluntary students and friends and relatives (396 males and 532 women). The students were 195. The average age was 30.69 ($SD= 11.62$; range: 18-77), for males 31.28 ($SD= 11.84$; range: 18-77) and for females 30.11 ($SD= 11.32$; range 18-75). In accordance with the usual age distribution, four age groups were arbitrarily formed considering an equivalent proportionality of subjects in each age group. It should be noted that in the studies on personality structure analyses, it is important to bear in mind a normal frequency distribution regarding the available sample. Age frequencies for the whole sample were: Group 1 (18-24, $M= 19.98$, $SD= 1.84$, $n= 316$, 34.1%), Group 2 (25-30, $M= 26.87$, $SD= 1.70$, $n= 292$, 31.5%), Group 3 (31-45, $M= 38.24$, $SD= 4.01$, $n= 168$, 18.1%), and Group 4 (> 45, $M= 51.42$, $SD= 4.90$, $n=152$, 16.4%). There were no significant age differences between male and female as evaluated by a *t*-test, with a small effect size ($d= 0.10$). A total of 19 participants were not included in the study because of missing data (over 5 blank responses) and/or at least one poor validity item.

Instrument

We used the Spanish version of the Temperament and Character Inventory-Revised (TCI-R; Gutiérrez-Zotes et al., 2004). The TCI-R is a 240-item self-administered questionnaire designed to measure 4 temperaments, Novelty Seeking (NS), Harm Avoidance (HA), Reward Dependence (RD), and Persistence (PS), and three characters, Self-directedness (SD), Cooperativeness (CO), and Self-transcendence (ST). The TCI-R items are listed in random order and grouped into facets. Approximately half of the items are reverse scored. The Temperament facets were Novelty Seeking (NS): Exploratory excitability (NS1), Impulsiveness (NS2), Extravagance (NS3) and Disorderliness (NS4); Harm Avoidance (HA): Anticipatory worry (HA1), Fear of uncertainty (HA2), Shyness with strangers (HA3) and Fatigability (HA4); Reward Dependence (RD): Sentimentality (RD1), Openness to warm (RD2), Attachment (RD3) and Dependence (RD4); Persistence (PS): Eagerness of effort (PS1), Work hardened (PS2), Ambitious (PS3) and Perfectionist (PS4); whereas the Character facets were Self-directedness (SD): Responsibility (SD1), Purposefulness (SD2), Resourcefulness (SD3), Self-acceptance (SD4) and Enlightened second nature (SD5); Cooperativeness (CO): Social acceptance (C1), Empathy (C2), Helpfulness

(C3), Compassion (C4), Pure-hearted conscience (C5); Self-transcendence (ST): Self-forgetful (ST1), Transpersonal identification (ST2) and Spiritual acceptance (ST3).

Data analysis

Descriptive statistics, mean differences, and alpha internal consistencies for all subjects, by sex and age groups were analyzed. Effect sizes were estimated from *t*-tests. Inter-correlations among the seven dimensions of the TCI-R were also obtained. The factor structure was analyzed through a Principal Component Analysis (PCA) with Promax rotation for each age group. Additionally, these factor structures were compared and the factorial congruence coefficients were independently estimated for the facets of the Temperament and Character factors. A Confirmatory Factor Analysis (CFA) comparing the models for each age group was also carried out, both considering the simple structure, and incorporating the secondary loadings (salient and modest loadings).

Results

Descriptive and correlation analysis

Table 1 shows descriptive statistics and alpha reliabilities for the whole sample and sex. For the general sample, kurtosis and skewness were close to zero, the alphas were between 0.74 and 0.89. There were similar outcomes for the male and female sub-samples. Females obtained higher scores than males in HA ($d = -.48$), RD ($d = -.64$), and C ($d = -.51$), with medium effect sizes. The correlation of the TCI-R facets with age is also shown, with the highest coefficients being with NS1, NS4, HA2, RD3, PS1, PS3, and SD4. These outcomes are better visualized through Figure 1, which displays the comparison of centred mean scores in the Temperament and Character dimensions by sex and age group. Whereas these differences between males and females were remarkable and even expectable, it should be noticed that they differed in a greater extent when considering the age groups. Table 2 shows mean comparisons by age groups. Bonferroni pairwise comparisons are shown at the second half of the Table 2, indicating some notable differences: the youngest participants (Groups 1 and 2) scored higher in NS, SD and ST, while older subjects (Groups 3 and 4) scored higher in HA, SD, and CO. There was no interaction, however, between age and sex in the prediction of any of the TCI-R variables, with non-significant $\eta^2 \leq .004$ values. Table 3 shows the correlation coefficients among the Temperament and Character scales of the TCI-R. HA correlated negatively with PS (-.32) and SD (-.41) and positively with SD (.29) and ST (.29). RD correlated positively with C (.54) and SD with C (.55). Nevertheless, it should be noted that the sample size increased the power of this test making significant minimal correlation values. However, it should also be considered that these correlations were equivalent to those reported in past research.

Table 1
TCI-R descriptive, means comparison for sex and alpha

Facets and scales	<i>r</i> Age	Items	All (<i>n</i> = 928)			Males (<i>n</i> = 396)			Females (<i>n</i> = 532)			Cohen's <i>d</i>
			<i>M</i>	<i>SD</i>	α	<i>M</i>	<i>SD</i>	α	<i>M</i>	<i>SD</i>	α	
NS1.Exploratory exctability	-.25	10	31.77	4.94	.49	31.47	5.22	.54	31.99	4.72	.44	-.11
NS2.Impulsiveness	-.12	9	23.05	5.56	.69	23.30	5.44	.67	22.86	5.65	.71	.08
NS3.Extravagance	-.16	9	27.73	4.18	.72	27.57	4.34	.71	27.85	4.05	.72	-.07
NS4.Disorderliness	-.36	7	19.40	4.41	.51	20.11	4.42	.51	18.87	4.33	.50	.28
NS. Novelty Seeking	-.33	35	101.95	12.43	.74	102.45	12.30	.76	101.58	12.54	.78	.07
HA1.Anticipatory worry	-.06	11	30.82	6.20	.68	29.33	5.58	.60	31.94	6.41	.70	-.43
HA2.Fear of uncertainty	.21	7	23.78	5.11	.70	21.97	5.05	.68	25.12	4.72	.66	-.65
HA3.Shyness with strangers	.09	7	20.58	5.36	.76	20.40	5.30	.75	20.71	5.41	.78	-.06
HA4.Fatigability	.05	8	22.34	5.13	.68	21.38	4.95	.67	23.05	5.16	.68	-.33
HA. Harm Avoidance	.09	33	97.52	16.44	.86	93.08	16.07	.85	100.82	15.94	.85	-.48
RD1.Sentimentality	-.02	8	28.69	4.74	.61	26.99	4.58	.57	29.95	4.47	.58	-.66
RD2.Opennes to warm	-.16	10	36.34	6.94	.79	34.60	7.01	.78	37.64	6.60	.78	-.45
RD3.Attachment	-.20	6	21.90	5.06	.77	20.63	5.16	.76	22.84	4.78	.75	-.45
RD4.Dependence	.05	6	20.79	3.70	.48	20.11	3.97	.56	21.30	3.40	.38	-.33
RD. Reward Dependence	-.13	30	107.72	15.34	.85	102.34	15.32	.84	111.73	14.09	.83	-.64
PS1.Eagerness of effort	.29	9	29.48	5.64	.68	28.83	5.81	.70	29.96	5.47	.68	-.20
PS2.Work hardened	.01	8	26.96	5.22	.72	26.88	5.23	.71	27.02	5.22	.73	-.03
PS3.Ambitious	-.18	10	30.13	6.42	.78	31.30	6.41	.77	29.25	6.29	.76	.32
PS4.Perfectionist	.06	8	25.72	5.34	.72	25.89	5.25	.70	25.60	5.40	.73	.05
PS. Persistence	.04	35	112.29	18.15	.89	112.91	18.51	.89	111.83	17.87	.89	.06
SD1.Responsability	-.03	8	30.98	5.27	.73	30.86	5.27	.74	31.07	5.27	.73	-.04
SD2.Purposefulness	-.04	6	23.14	4.25	.69	22.95	4.34	.72	23.28	4.19	.67	-.08
SD3.Resourcefulness	-.01	5	18.25	3.52	.63	18.46	3.62	.68	18.09	3.43	.60	.11
SD4.Self-acceptance	.23	10	32.23	6.79	.73	31.39	7.05	.76	32.86	6.52	.71	-.22
SD5.Enlightened second nature	.12	11	38.64	5.61	.65	38.45	5.49	.64	38.78	5.70	.66	-.06
SD. Self-directiveness	.11	40	143.23	17.89	.86	142.11	18.18	.86	144.07	17.64	.85	-.11
CC1.Social acceptance	.01	8	31.77	4.95	.77	30.86	5.17	.78	32.45	4.66	.75	-.33
CC2.Empathy	-.13	5	18.66	3.12	.52	17.91	3.32	.54	19.22	2.84	.46	-.43
CC3.Helpfulness	.14	8	30.41	4.16	.58	29.47	4.37	.61	31.11	3.85	.52	-.40
CC4.Compassion	.12	7	27.37	5.49	.84	26.15	5.76	.85	28.27	5.11	.83	-.39
CC5.Pure-hearted conscience	.00	8	30.76	4.68	.56	29.84	4.90	.56	31.45	4.39	.54	-.35
CO. Cooperativeness	.05	36	138.97	16.88	.88	134.22	17.57	.88	142.50	15.44	.86	-.51
ST1.Self-forgetful	-.12	11	32.30	6.86	.72	32.05	6.80	.71	32.49	6.90	.73	-.06
ST2.Transpersonal identification	.09	8	20.86	5.63	.73	20.51	5.62	.72	21.12	5.63	.72	-.11
ST3.Spiritual acceptance	.02	9	19.55	6.40	.79	18.81	6.04	.76	20.10	6.61	.81	-.20
ST. Self-transcendence	-.01	27	72.71	15.15	.85	71.37	14.58	.89	73.71	15.51	.86	-.15

Note: Correlations $\geq .12$ are significant at the $p < .001$ level.

Table 2
TCI-R descriptive means comparison for age groups and alpha reliabilities

Scales	Group 1 ≤ 25 years (n= 316)		Group 2 25-30 years (n= 292)		Group 3 31 - 45 years (n= 168)		Group 4 45 years (n= 152)					
	M	SD	α	M	SD	α	M	SD	α			
NS: Novelty Seeking	106.43	10.56	.72	102.47	12.87	.78	99.21	11.92	.76	94.67	11.66	.73
HA: Harm Avoidance	96.44	15.40	.86	97.64	17.00	.87	95.51	17.63	.88	101.75	15.46	.82
RD: Reward Dependence	110.23	14.29	.85	107.02	16.35	.87	107.43	14.51	.82	104.17	15.64	.84
PS: Persistence	110.37	17.19	.89	112.61	19.04	.90	115.20	18.70	.89	112.43	17.40	.86
SD: Self-directiveness	139.00	17.18	.86	144.65	18.11	.86	148.24	17.99	.86	143.78	17.00	.82
CO: Cooperativeness	137.49	17.52	.90	138.26	17.45	.89	143.05	15.27	.85	138.88	15.49	.83
ST: Self-transcendence	76.12	13.54	.83	69.02	14.48	.85	70.55	16.19	.87	75.11	16.49	.87
Group 1, ≤ 25 years	---			NS ³ , SD ³ , ST ³			NS ³ , PS ¹ , SD ³ , CO ² , ST ³			NS ³ , HA ² , RD ³ , SD ¹		
Group 2, > 25-30 years				---			NS ¹ , CO ¹			NS ³ , ST ³		
Group 3, 31 - 45 years							---			NS ² , HA ² , ST ¹		
Group 4, > 45 years										---		

Note: ¹p < .05; ²p < .01; ³p < .001.

Table 3
Correlations among Temperament and Character Scales of the TCI-R

<i>All groups</i>	NS	HA	RD	PS	SD	CT	ST
NS	---						
HA	-.27	---					
RD	.16	-.07	---				
PS	-.11	-.32	.17	---			
SD	-.19	-.42	.19	.30	---		
CO	-.14	-.14	.53	.16	.56	---	
ST	.14	-.08	.18	.29	-.16	.08	---

Notes:

Coefficients lower than .10 are significant at $p < .05$; the other coefficients are significant at $p < .001$. NS= Novelty Seeking; HA = Harm Avoidance; RD= Reward Dependence; PS= Persistence; SD= Self-Directedness; C= Cooperativeness; ST= Self-Transcendence.

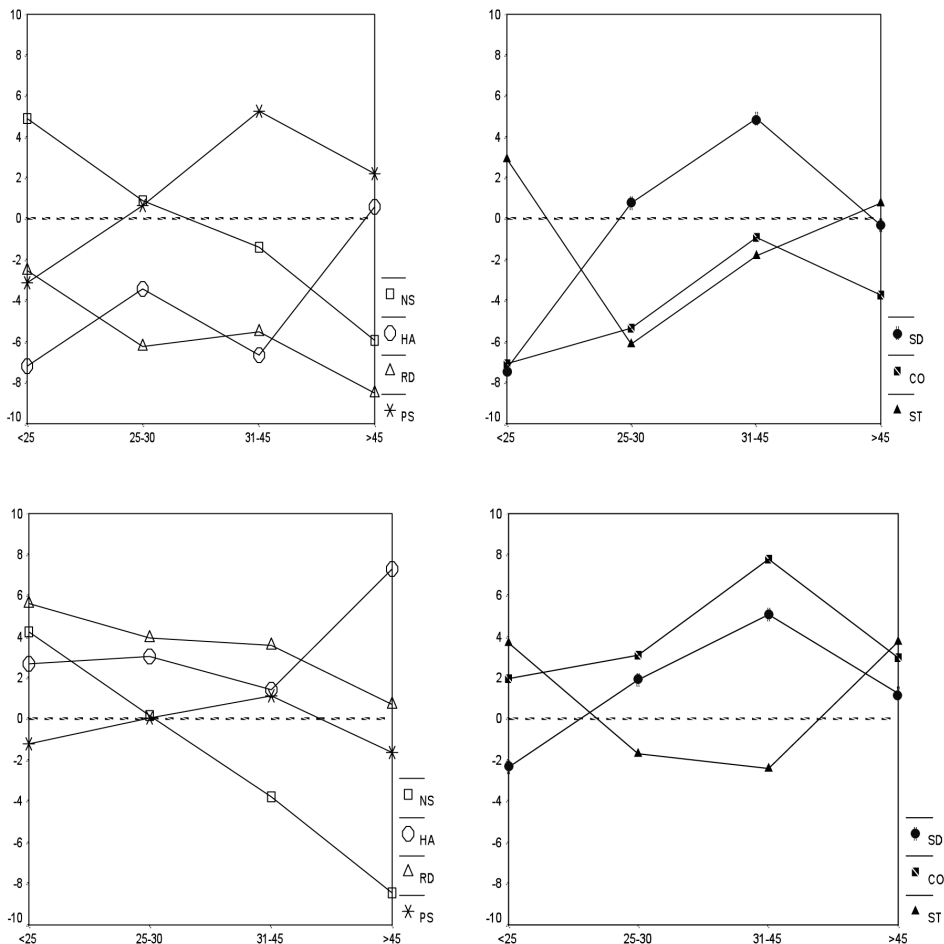
Structure and congruence coefficients by age groups

Principal Component analyses were conducted with Promax rotation for the total sample and for each age group, with the obliquity parameter set to 0 in a two step procedure: (a) using the 16 facets of Temperament; and (b) using the Character dimensions. Tables 4 and 5 show the factorial matrices, and congruence coefficients for the full sample and age groups. For the full sample, four Temperament facets were extracted in accordance with the "eigenvalue one" criteria, explaining 61.61% of the total variance (Factor 1: 23.47%, Factor 2: 16.05%, Factor 3: 14.54%, Factor 4: 7.55%). The same procedure was replicated for the age groups with similar results. Total congruence coefficients ranged between .76 and 1 for facets, and .92 and 0.95 for factorial matrices (see, Table 4). Besides, PCA analyses with the Character facets were performed for the full sample and age groups with Promax rotations and "eigenvalue one" criteria. We extracted three factors that accounted de 59.88% of the total variance (Factor 1: 32.07%, Factor 2: 16.84%, Factor 3: 10.97%). Total congruence coefficients ranged between .86 and 1 for facets, and .95 and .98 for factorial matrices (Table 5).

Confirmatory Factorial Analysis

The Confirmatory Factor Analyses (CFA) were conducted over the covariance matrices of the 16 and 13 Temperament and Character TCI-R facets. The analyses were performed through the AMOS 7.01 statistical package and the Maximum Likelihood estimation method. Five models increasing in complexity,

Figure 1
Centred mean scores for the temperament and character dimensions by age groups



Note: The dotted line indicates the mean score. The top figures are for males, the bottom figures are for females.

and similar to those analysed by McCrae et al. (1996) with the NEO-PI-R, were designed. We tested 4 and 3 factor models (Temperament and Character) for all subjects and the four age groups. Free loadings in each model were: 1) *Simple structure*: All facets were linked to its own single latent factor only, 2) *Salient loadings*: All loadings larger than ± 0.30 , and 3) *Modest loadings*: all loadings larger than ± 0.20 .

Table 4
Principal components analysis (Promax) of TCI-R Temperament scales and congruency coefficients between age groups

TCI-R Temperament scales (n= 928)	Factor 1	Factor 2	Factor 3	Factor 4	G1-G2	G1-G3	G1-G4	G2-G3	G2-G4	G3-G4
NS1. Exploratory excitability	.243	-.359	.560	.290	.97	.99	.92	.94	.85	.94
NS2. Impulsiveness	.694	-.127	.058	-.315	1	.95	.87	.94	.88	.98
NS3. Extravagance	.385	-.204	.360	-.329	.85	.91	.91	.97	.99	1
NS4. Disorderliness	.809	-.141	.086	-.099	.77	.77	.70	.92	.90	.97
HA1. Anticipatory worry	-.102	.801	-.080	-.150	.99	.96	.97	.97	.95	.94
HA2. Fear of uncertainty	-.412	.793	-.068	-.188	.99	.99	.98	.98	.97	.95
HA3. Shyness with strangers	-.221	.612	-.538	-.159	.94	.94	.95	.91	.97	.95
HA4. Fatigability	-.023	.677	-.069	-.437	.97	.94	1	.99	.95	.92
RD1. Sentimentality	-.174	.408	.556	.228	.89	.80	.75	.96	.95	.88
RD2. Openness to warm	.032	-.118	.872	.221	.98	.99	.96	.99	.98	.95
RD3. Attachment	.038	-.078	.819	.026	.98	.94	.91	.99	.97	.99
RD4. Dependence	-.502	.316	.422	-.107	.98	.90	.84	.93	.82	.76
PS1. Eagerness of effort	-.270	-.098	.174	.725	.97	.98	.98	.93	.93	1
PS2. Work hardened	-.159	-.299	.198	.819	.99	.98	.97	.97	.99	.98
PS3. Ambitious	.261	-.237	.110	.748	.92	.96	.94	.99	.93	.95
PS4. Perfectionist	-.215	-.167	.092	.858	.97	.95	.96	.97	.98	1
<i>Total congruency coefficient</i>					.95	.94	.92	.96	.94	.95

Notes:

TCI-R= Temperament and Character Inventory Revised; G1: <26 years; G2: 26-30 years; G3: 31-45 years; G4: > 45 years.
Values above .35 are shown in boldface.

Table 5
Principal components analysis (Promax) of TCI-R Character scales and congruency coefficients between age groups

TCI-R Character scales (n= 928)	Factor 1	Factor 2	Factor 3	G1-G2	G1-G3	G1-G4	G2-G3	G2-G4	G3-G4
SD1. Responsibility	.675	.117	-.301	.97	.94	.97	.97	1	.98
SD2. Purposefulness	.845	-.063	.107	1	.95	1	.97	1	.97
SD3. Resourcefulness	.861	-.098	.011	1	.98	.90	.96	.88	.97
SD4. Self-acceptance	-.134	.664	-.362	.99	1	.91	.98	.96	.89
SD5. Enlightened second nature	.719	.104	-.036	.97	1	.85	.98	.91	.85
C1. Social acceptance	.089	.727	.087	.99	.98	.96	1	.99	.99
C2. Empathy	.191	.495	.302	.99	.96	.93	.99	.96	.98
C3. Helpfulness	.055	.805	-.044	.99	.95	.98	.91	.96	.90
C4. Compassion	-.188	.861	.060	.99	1	.96	.98	.94	.98
C5. Pure-hearted conscience	.137	.592	.076	.97	.97	.99	1	.99	.99
ST1. Self-forgetful	.025	-.078	.823	1	.99	.92	1	.92	.95
ST2. Transpersonal identification	-.007	.103	.836	.99	.95	.99	.99	.98	.96
ST3. Spiritual acceptance	-.093	.067	.673	.98	1	1	.99	.99	1
Total congruency coefficient				.98	.97	.95	.98	.96	.96

Notes:
TCI-R= Temperament and Character Inventory Revised; G1: <26 years; G2: 26-30 years; G3: 31-45 years; G4: > 45 years.
Values above .35 are shown in boldface.

Table 6
Goodness-of-Fit Indices of the TCI-R Temperament-Character Scales

Temperament	Groups	χ^2	df	GFI	IFI	TLI	CFI	RMSEA	Character	Groups	χ^2	df	GFI	IFI	TLI	CFI	RMSEA
Simple structure	All	1417.41		.84	.74	.68	.74	.12		All	560.13		.91	.88	.84	.88	.09
	1	456.18	98	.85	.78	.73	.78	.11	Simple structure	1	209.78	62	.91	.90	.87	.90	.09
	2	560.97		.80	.75	.69	.75	.13		2	245.40		.88	.87	.83	.87	.10
	3	348.61		.81	.73	.67	.73	.12		3	159.39		.87	.86	.82	.86	.10
	4	358.89		.78	.67	.58	.66	.15		4	207.17		.81	.75	.68	.75	.13
Salient loadings	All	702.92		.92	.88	.84	.88	.09		All	357.11		.94	.93	.90	.93	.07
	1	247.27	88	.91	.90	.86	.90	.08	Salient loadings	1	172.34	59	.92	.92	.90	.92	.08
	2	265.59		.90	.90	.87	.90	.08		2	178.53		.91	.92	.89	.91	.08
	3	233.03		.87	.85	.79	.84	.10		3	125.24		.90	.90	.87	.90	.08
	4	242.47		.84	.81	.72	.80	.11		4	130.98		.89	.88	.83	.87	.09
Modest loadings	All	392.78		.95	.94	.90	.94	.07		All	257.64		.96	.95	.92	.95	.07
	1	183.16	77	.93	.94	.90	.93	.07	Modest loadings	1	145.15	51	.93	.94	.90	.94	.08
	2	190.58		.92	.94	.90	.94	.07		2	115.95		.94	.95	.93	.95	.07
	3	179.14		.89	.89	.83	.89	.09		3	105.15		.91	.92	.88	.92	.08
	4	157.74		.89	.90	.83	.89	.08		4	110.98		.90	.90	.84	.90	.09

Notes:
TCI-R= Temperament and Character Inventory Revised; Group 1: <26 years; Group 2: 26-30 years; Group 3: 31-45 years; Group 4: > 45 years.
 χ^2 values were significant at the $p < .001$.

Table 6 shows that the best fit was obtained for the modest loadings situation, as shown by progressively decreasing chi-square values as model complexity increased regardless of the age group. A fair fit to observed data was particularly found for the youngest age groups (Groups 1 and 2) in both, Temperament and Character models, when taking into account additional measures of fit. More precisely, fit indices for Group 1 were GFI= .93, IFI= .94, TLI= .90, CFI= .93, RMSEA= .07 (Temperament); GFI= .93, IFI= .94, TLI= .90, CFI= .94, RMSEA= .08 (Character). Equivalent outcomes were also found for the Group 2: GFI= .92, IFI= .94, TLI= .90, CFI= .94, RMSEA= .07 (Temperament); GFI= .94, IFI= .95, TLI= .93, CFI= .95, RMSEA= .07 (Character). Thus, there were age differences regarding the TCI-R factor structure, although most notably for the over-parameterized models that included high secondary factor loadings.

Discussion

This research was designed to analyze the effect of age in the answers of the participants and in the TCI-R factorial structure. The studied sample was large and it was composed by healthy and motivated subjects that represent in a relatively uniform way four age groups between 18 and 77 years. The global descriptive and factorial analyses suggest that the means, standard deviation, sex differences and internal consistencies were similar to those obtained in other studies in the same social context (Gutiérrez-Zotes et al., 2004).

The factorial structure on the Temperament scales indicates that NS1 did not load in the NS factor, with a positive factor loading in RD and a negative factor loading in HA. Besides, HA2 and HA4, RD1 and RD4 yielded high secondary loadings onto a different factor. These outcomes suggest that the PS facets were orthogonal, whereas the NS, HA and RD were not independent, showing a high overlap. Regarding the outcomes on the Character scales, it was found that SD4 had high secondary loadings in different factors. Overall, these outcomes resemble those found in past research (Gutiérrez-Zotes et al., 2004; Pelisolo et al., 2005), indicating that the facets which load in different factors should be reviewed in future works in order to improve the TCI-R construct validity. Moreover, it should be noticed that this irregular factorial pattern held for all age groups as shown by the congruence data, thus, the lack of robustness in the Temperament and Character facets might be probably due to facet design.

In regard to the association of age with the TCI-R, the findings of the present study suggest that there were some differences concerning the Temperament and Character dimensions of the TCI-R. The youngest individuals (up to 25 years old) reported significant mean differences in the NS, HA, RD, and PS Temperament dimensions, and also in the SD, CO, and ST Character dimensions for older age groups. Moreover, there were significant mean differences in the NS and HA Temperament dimensions, and also in the ST Character dimensions between age groups. It should be noticed that older subjects scored higher in HA, corroborating the results reported elsewhere (Preiss et al., 2007). Nevertheless, and considering that HA taps neuroticism, these

outcomes are somehow contradictory with data reported by the NEO-PI-R (Srivastava et al., 2003; Terracciano et al., 2005). The rest of the TCI-R dimensions did not show a clear association with age. In addition, there were no interactions between age and sex with the TCI-R scales. Essentially, Females scored higher in Reward Dependence (RD1, Sentimentality), Cooperativeness and Harm Avoidance than males. These outcomes are consistent with the data reported with participants in a similar cultural context (Gutiérrez-Zotes et al., 2004). Age differences did not affect the factor structure analyses. The outcomes indicated a fairly congruence of the factor structure amongst age groups, suggesting factor structure invariance for both, the Temperament and Character scales, although some variations could be expected in regard to the Character scales due to its closer association with learning and culture.

In the introductory section it has been mentioned that some authors consider that the CFA is not an appropriate tool to demonstrate the replicability of the simple structure of a personality questionnaire (McCrae et al., 1996). The NEO-PI-R presents a robust structure in the EFA, but the CFA offers unsatisfactory goodness-of-fit and it is necessary to increase the complexity of the model towards a complete structure to obtain a satisfactory adjustment to data (Aluja et al., 2005). In the case of the TCI-R the results are similar to the NEO-PI-R, because while the obtained structure through EFA is robust for Temperament and Character, the CFA presents an inadequate adjustment for the whole sample and for each age group. Nevertheless, after incorporating the salient and modest loadings the fit indexes improved substantially. CFA analyses suggested a slight better fit to observed data for the younger age groups (Groups 1 and 2) than for the older groups (Groups 3 and 4) when freeing salient and modest factor loadings. This finding could suggest that the structure of the TCI-R could be more stable in the younger groups. However, this trend was not supported when comparing congruence coefficients between young and old age groups in EFA analyses. Although the sample used in the study consists of people from a wide age range, the results might be not generalized to the general population due to the non representativeness from the Spanish census. The factor solutions in Temperament and Character are very similar to those found in past research in different cultural contexts mentioned in the introductory section. Therefore, it may be argued that the cultural differences related to the TCI-R are negligible, which might be probably attributed to the fact that a previously validated Spanish version of the TCI-R was used in the present study (Gutiérrez-Zotes et al., 2004), who reported also no significant cultural differences in their study.

The objective of the present study was to study the differences in raw scores and factor structure of the TCI-R in regard to different age groups from the general population. Nevertheless, these outcomes may be of help also for clinical and/or applied psychology as both normal and pathological personality show a great degree of similarity. On the other hand, means and standard deviations from the present study might be used to compare the scores obtained by clinical groups. Moreover, different contributions may be noticed from the findings in the present study in regard to the TCI-R with the Spanish population: (a) the temperament and character structure is fairly replicated, (b) it provides statistical information in regard to mean scores yielded by each age group, (c) it highlights that the differences in

regard to the factor structure were negligible for the age groups, and (d) it provides information about the factor inter-relationships and adjustments of different models in regard to secondary factor loadings as shown elsewhere with other personality questionnaires. Overall, the present study provides a better technical understanding of this important instrument in the Spanish population. Despite the fact that the TCI-R is based on a model on psychopathology (Cloninger & Svrakic, 1997), the availability of technical data on age differences and about its factorial structure is important to gain a better knowledge of this instrument. Notice that clinical-oriented instruments such as the MCMI, GHQ, SCL-90-R or the MMPI, are also usually replicated with the general population, given that it may be assumed that personality disorders are an exaggeration of normal personality traits (Widiger, Trull, Clarkin, Sanderson, & Costa, 2002).

Nevertheless, a limitation in the present study could be related with its sample size. Given the factorial nature of the study, a wider sample size could be likely needed, in order to increase age groups with a greater number of subjects. On the other hand, the fact of using scales instead of items in the factor analyses, together with the fact of having over 150 individuals in each age group may be considered as adequate. Future studies on the TCI-R factor structure might bear these considerations in mind.

Summing up, the current study indicated that the psychometric properties of the TCI-R when studied separately in accordance to Temperament and Character scales were similar to those reported elsewhere. The factor structure of the Temperament and Character dimensions were highly interrelated, as shown by the high secondary loadings and even by facets that were not loading in its own factor. This finding has already been reported in other research as mentioned in the introductory section, which suggests the need to a further review of the instrument aiming at obtaining a more robust factor structure. In addition, the bad fit observed in the CFA might be due to these high secondary loadings, and the high facets inter correlations. This fact has also been observed with the NEO-PI-R, thus, it is necessary to study the complete structure that incorporates error correlation to improve the model goodness of fit. The younger participants tended to score higher in Novelty Seeking and Reward Dependence, while the older participants obtained higher scores in Self-Directiveness. In addition, responses to the scales fluctuated across age groups and sex, with the only linear relationship being indicated by Novelty Seeking. The observed age differences did not affect the structure of the TCI-R which remained invariable in all the age groups.

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