

The Five and Seven Factors Personality Models: Differences and Similitude between the TCI-R, NEO-FFI-R and ZKPQ-50-CC

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The present study tests the relationships between the three frequently used personality models evaluated by the Temperament Character Inventory-Revised (TCI-R), Neuroticism Extraversion Openness Five Factor Inventory – Revised (NEO-FFI-R) and Zuckerman-Kuhlman Personality Questionnaire-50- Cross-Cultural (ZKPQ-50-CC). The results were obtained with a sample of 928 volunteer subjects from the general population aged between 17 and 28 years old. Frequency distributions and alpha reliabilities with the three instruments were acceptable. Correlational and factorial analyses showed that several scales in the three instruments share an appreciable amount of common variance. Five factors emerged from principal components analysis. The first factor was integrated by A (Agreeableness), Co (Cooperativeness) and Agg-Host (Aggressiveness-Hostility), with secondary loadings in C (Conscientiousness) and SD (Self-directiveness) from other factors. The second factor was composed by N (Neuroticism), N-Anx (Neuroticism-Anxiety), HA (Harm Avoidance) and SD (Self-directiveness). The third factor was integrated by Sy (Sociability), E (Extraversion), RD (Reward Dependence), ImpSS (Impulsive Sensation Seeking) and NS (novelty Seeking). The fourth factor was integrated by Ps (Persistence), Act (Activity), and C, whereas the fifth and last factor was composed by O (Openness) and ST (Self- Transcendence). Confirmatory factor analyses indicate that the scales in each model are highly interrelated and define the specified latent dimension well. Similarities and differences between these three instruments are further discussed.

Keywords: *personality, TCI-R, NEO-FFI-R, ZKPQ-50-CC.*

Este estudio explora las relaciones entre los tres modelos de personalidad más frecuentemente utilizados evaluados por el Inventario de Carácter y Temperamento revisado (TCI-R), el Inventario de Neuroticismo, Extraversión y Apertura Revisado de Cinco Factores Revisado (NEO-FFI-R) y el Cuestionario de Personalidad de Zuckerman-Kuhlman de 50 ítems (el ZKPQ-50-CC). Los resultados se obtuvieron con una muestra de 928 sujetos voluntarios provenientes de la población general entre 17 y 28 años. Las distribuciones de frecuencias de las medias y fiabilidades alfa de los tres instrumentos fueron aceptables. Los análisis correlacionales y factoriales mostraron que los tres cuestionarios compartían una apreciable cantidad de varianza común. De los análisis de componente principales emergieron cinco factores. El primer factor quedó integrado por A (Amabilidad), Co (Cooperación) y Agg-Host (Agresividad-hostilidad), con las cargas secundarias en el factor C (Responsabilidad) y SD (Auto-Dirección) de otros factores. El segundo factor estaba compuesto por N (Neuroticismo), N-Anx (Neuroticism-ansiedad), HA (Evitación del Daño) y SD (Auto-Dirección). El tercer factor quedó integrado por Sy (la Sociabilidad), E (Extraversión), RD (Dependencia de la Recompensa), ImpSS (Búsqueda de Sensaciones Impulsiva) y NS (Búsqueda de Novedad). El cuarto factor quedó integrado por P (Persistencia), Act (Actividad), y C, el quinto y el último factor estaba compuesto por O (Apertura) y ST (Auto-Transcendencia). Un análisis factorial confirmatorio indicó que las escalas de cada modelo están muy interrelacionadas y definen bien la dimensión latente especificada. Se discuten las similitudes y diferencias entre estos tres instrumentos.

Palabras clave: *personalidad, TCI-R, NEO-FFI-R, ZKPQ-50-CC.*

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In the present research on personality there are three frequently used models: the Five Factor model (FFM) (Tupes & Christal, 1961) measured by the NEO-PI-R (Costa & McCrae, 1992), Cloninger Temperament and Character model (Cloninger, 1987) measured by the TCI-R (Cloninger, Svrakic, & Przybeck, 1993), and Zuckerman Big Five alternative model measured by the ZKPQ (Aluja, García, & García, 2002; Zuckerman, Kuhlman, Joreiman, Teta, & Kraft, 1993; Zuckerman, Kuhlman, Thornquist, & Kiers, 1991).

The FFM clearly predominates in accordance with the high amount of works dealing with this theory. This model originated in the lexical tradition based in the description of psychological traits represented by natural language and adjectives (Digman, 1990; Goldberg, 1981; Norman, 1967). In addition, this model pretends to provide a descriptive taxonomy of personality with no mention to causal or biological aspects. There is a generalized agreement regarding the labeling of the big five factors as Neuroticism (N), Extraversion (E), Conscientiousness (C), Agreeableness (A) and Openness to Experience (O), despite particular nomenclatures may change slightly (Goldberg, 1981, 1990). These five factors are theoretically independent or orthogonal, although E and O are highly intercorrelated, whereas A and C appear to share a common construct which might be named as 'socialization' that some authors have interpreted as the inverse the Eysenck's Psychoticism dimension (Eysenck, 1991, 1992a, 1992b; McCrae, & Costa, 1985). This model has been widely replicated in different cultural contexts (McCrae, Terracciano, & 78 Members of the Personality Profiles of Cultures Project, 2005).

Cloninger's personality model is based in two historical components of personality, Temperament and Character. Temperament is defined by four factors: Novelty Seeking (NS), Harm Avoidance (HA), Reward Dependency (RD), and Persistence (Ps), whereas Character has been defined by three factors: Self-Directiveness (SD), Cooperation (Co), and Self-Transcendancy (ST). The temperament traits have been hypothesized to be related with neural monaminergic systems (Cloninger, 1986). The temperament traits are supposed to be associated with the biology, whereas character traits would be more related to learning and culture. However, the evidence about the independence between temperament and character factors is inconclusive. In a recent study Farmer and Goldberg (2008) showed psychometric hindrances and an insufficient factor structure validation for the TCI-R and the TCI. Moreover, Temperament and Character dimensions tend to correlate, for example, RD is positively correlated with Co, whereas HA is negatively correlated with Co although several studies also suggest more substantial correlations (negative) with PS and SD than with Co. NS, has also been related with RD, which is also within the Extraversion construct (De Fruyt, Van de Wiele, & Heeringen, 2000). Further, when factorizing the facets in seven factors a non-stable structure is usually obtained, with facets from different factors loading

in a single factor. In a recent study, Maitland, Nyberg, Bäckman, Nilson, and Adolfsson (2009) analyze several temperament-character models with Structural Equation Modelling techniques. The results provide no support for distinguishing Temperament and Character dimensions.

The Zuckerman Big Five alternative model is based in the biological-factorial tradition and is closely related with the Eysenck model. The five factors are Neuroticism-Anxiety (N-Anx), Sociability (Sy), Aggression-Hostility (Agg-Host), Impulsive Sensation Seeking (ImpSS), and Activity (Act). A full description of this questionnaire and its psychometric properties may be reviewed in Zuckerman (2002, 2008) and Joreiman and Kuhlman (2004). N-Anx tends to correlate with Agg-Host, and Sy with ImpSS and Agg-Host. Unlike the TCI-R or the NEO-PI-R, the factor structure of this questionnaire is obtained directly from the items, is generally robust and has been also replicated in different cultures (Aluja, et al. 2006; 2008).

De Fruyt et al. (2000) investigated the relationships of Cloninger's model as measured by the TCI, with the FFM model as measured by the NEO-PI-R. N obtained a high positive correlation with HA, and a negative correlation with SD. Further, E was negatively correlated with HA, and positively correlated with RD and NS. In addition, O was positively correlated with ST, and in a lesser extent negatively correlated with RD and HA. Finally, A was positively correlated with Co, whereas C was positively correlated with Ps and SD.

Zuckerman et al. (1993) and Aluja, García, and García (2002) have studied the relationships between the NEO-PI-R, the EPQ and the ZKPQ in different cultures, indicating essentially equivalent results. Psychoticism was negatively associated with C and A, and also with ImpSS and Agg-Host from the ZKPQ. Openness was located in the *Extraversion factor*. The *Psychoticism factor* scales are split into two factors: Agreeableness and Conscientiousness. The first one is formed by A, Agg-Host, and O. The second one is formed by C, P, and ImpSS. Finally, in the 5-factor solution, when adding the 30 NEO PI-R facets, the six facets of Openness formed an independent factor. In this model, Psychoticism was grouped with ImpSS, Impulsivity (N5) and the six Conscientiousness facets (negative loadings).

The relationships between the Cloninger, Zuckerman and Eysenck models were studied by Zuckerman and Cloninger (1996). NS obtained high inter-correlations with ImpSS, Psychoticism and Extraversion (EPQ). HA was positively related with N-Anx, N, and negatively related with E. On the other hand, RD was negatively related with Psychoticism, Ps was correlated with Act, Co was negatively correlated with Agg-Host and Psychoticism, SD was negatively correlated with N-Anx and N, and finally, ST was only slightly related with ImpSS.

As far as we know, there are no studies comparing simultaneously these three personality models, although in the light of past research it is expected to find a high amount

of common variance shared by Neuroticism scales and HA. Further, it is also expected a high degree of covariation among the scales tapping Extraversion (Sy, ImpSS, NS, and RD). On the other hand, it seems plausible that A, Agg-Host and Co should be highly correlated, and that C, Co, Act and Ps should also share a noticeable amount of shared variance. In regard to O and ST, these two scales should also be highly correlated.

Therefore, the aim of the current study was to compare the TCI-R, NEO-FFI-R and ZKPQ-50-CC dimensions and to analyze their empirical relationships. The above associations were expected, although we were also interested in knowing about the multivariate relationships amongst the three questionnaires in an attempt to better understand its links.

Method

Participants

Participants were 928 voluntary students and friends and relatives (396 males and 532 women). Thirty trained students collected the data and received course credit for it. 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). Age frequencies for the whole sample were: 18-24 ($M = 19.98$ (1.84); $n = 316$, 34.1%); 25-30 ($M = 26.87$ (1.70); $n = 292$, 31.5%); 31-45 ($M = 38.24$ (4.01); $n = 168$, 18.1%); and > 45 ($M = 51.42$ (4.90); $n = 152$, 16.4%). There were no significant age differences between male and female. The computed effect size was small ($d = 0.10$; Cohen, 1988; t -test: 1.52, $p < 0.13$). 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 in accordance with the TCI-R 5-item validity scale that allows for the screening of random or vague responses.

Measures

TCI-R. 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) (Cloninger & Svrakic, 1997). The TCI-R items are listed in random order, with approximately half reversed-scored items. Items of each dimension are grouped into facets, but in this study only with the 7 dimensions were analyzed. For this study was used a validated Spanish translation of the Temperament and Character Inventory-Revised (TCI-R; Gutierrez-Zotes et al., 2004).

NEO-FFI-R. The NEO-FFI-R is a revised version of the NEO-FFI. Like the latter, the NEO-FFI-R is a shortened 60-item version (12 per scale) of the NEO-PI-R (Costa & McCrae, 1992), distributed in five scales: Neuroticism (N), Extraversion

(E), Openness (O), Agreeableness (A), and Conscientiousness (C). McCrae and Costa (2004) proposed this revised short version after the best items from a factor analysis. They replaced 14 items from the NEO-FFI with items taken from the NEO-PI-R. These new items were selected on the basis of four criteria: 1) to minimize the effects of acquiescence, 2) to increase the correlations with NEO-PI-R factor scores, 3) to diversify item content by selecting items from underrepresented facets, and 4) to increase the intelligibility of the items. Internal reliability coefficients of the NEO-FFI-R scales range from 0.75 to 0.82. The NEO-FFI-R psychometric properties were replicated in Spanish samples by Aluja, García, Rossier and García (2005), with a good item structure and alpha reliabilities ranging between 0.71 and 0.82.

ZKPQ-50-CC. This instrument is a 50-item version of the Zuckerman-Kuhlman Personality Questionnaire (Aluja et al., 2006; Zuckerman et al., 1993). This reduced version was obtained from the original 89-items through different procedures of item analysis carried out simultaneously in American, German, Spanish, and Swiss samples. This questionnaire includes only 10 items per scale: Impulsive Sensation Seeking (ImpSS), Neuroticism-Anxiety (N-Anx), Aggressiveness-Hostility (Agg-Host), Activity (Act), Sociability (Sy). In the present study, the Infrequency (*Inf*) scale was not further analyzed. The validation study of the ZKPQ-50-CC shows similar psychometric properties to the original ZKPQ in the four countries (Aluja et al., 2006).

Statistical analysis

Descriptive statistics, frequency distribution values and alpha internal consistency coefficients are shown for each scale from the TCI-R, NEO-FFI-R and ZKPQ-50-CC. Pearson product-moment correlations for the different scales of the three instruments were also computed, together with principal components analysis. Additional principal components analysis were also performed including the dimensions of the TCI-R, NEO-FFI-R and el ZKPQ-50-CC and extracting different factor solutions. One factor confirmatory factor analyses were also estimated considering the scales that shared common variance in the 5-factor solution obtained in the principal components analysis.

Results

Descriptive results

Table 1 shows means, standard deviations, distribution values and alphas for the analyzed questionnaires. Skewness and Kurtosis values for all questionnaires were close to zero suggesting that normality assumptions were fairly met. Alpha internal consistencies in the questionnaire dimensions ranged between 0.63 and 0.89, indicating a fair to good reliability in the three instruments.

Table 1
Descriptive and internal consistency of TCI-R, NEO-FFI-R and ZKPQ-50-CC

	Min	Max	Mean	SD	Skewness	Kurtosis	Alpha
NS. Novelty Seeking	60	142	101.95	12.43	.10	.22	.77
HA. Harm Avoidance	43	157	97.52	16.44	.10	.16	.86
RD. Reward Dependence	53	144	107.72	15.34	-.33	-.06	.85
Ps. Persistence	57	168	112.29	18.15	.00	.03	.89
SD. Self-directiveness	58	188	143.23	17.89	-.25	.34	.86
Co. Cooperativeness	54	179	138.97	16.88	-.77	.59	.88
ST. Self-transcendence	31	127	72.71	15.15	.30	.23	.85
N. Neuroticism	0	43	20.36	8.15	.23	-.36	.77
E. Extraversion	6	47	29.53	7.63	-.35	-.12	.77
O. Openness	8	48	28.07	6.97	.19	-.19	.66
A. Agreeableness	6	44	33.82	6.12	-.89	.91	.71
C. Conscientiousness	3	48	34.52	7.69	-.53	.00	.81
ImpSS. Impulsive Sensation Seeking	0	10	5.61	2.54	-.15	-.81	.72
N-Anx. Neuroticism-Anxiety	0	10	3.23	2.63	.64	-.50	.79
Agg-Host. Aggressiveness-Hostility	0	10	4.44	2.32	.14	-.59	.63
Act. Activity	0	10	4.48	2.59	.06	-.86	.74
Sy. Sociability	0	10	6.14	2.47	-.52	-.44	.72

Correlational and factorial analyses

Table 2 shows a correlation matrix amongst the dimensions and facets of the three questionnaires. High correlations above .50 were found between the scales of the different questionnaires. For the TCI-R and ZKPQ-50-CC: NS and ImpSS (0.50), HA and N-Anx (0.58), RD and Sy (0.55), Ps and Act (0.52), SD and N-Anx (-0.52), Co and Agg-Host (-0.44), and in a lesser extent ST and ImpSS (0.30). For the TCI-R and NEO-FFI-R: HA and N (0.67), HA and E (-0.50), RD and E (0.52), Ps and C (0.53), SD and N (-0.55), A (0.40) and C (0.58), Co and A (0.63), Co and C (0.40), and ST and O (0.44). Finally, for the ZKPQ-50-CC and NEO-FFI-R: ImpSS and E (0.41), N-Anx and N (0.68), and Agg-Host (-0.43) and A, and Sy and E (0.64).

The principal component analysis (PCA) with varimax rotation was performed between the TCI-R, NEO-FFI-R, and ZKPQ-50-CC scales. The Kaiser-Meyer-Olkin measure of sample adequacy was .80. With the eigenvalue-one factor extraction criteria, a 5-factor solution was obtained (Kaiser, 1961). The total explained variance by the five factors in each sample was 71.85%. Table 3 shows the factorial matrix of the 17 scales with the loadings ordered in descending order. The first factor was integrated by A, Co and Agg-Host, with secondary loadings in C and SD from other factors. The second factor was composed by N, N-Anx, HA and SD. The third factor was integrated by Sy, E, RD, ImpSS and NS. The fourth factor was integrated by Ps, Act, and C, whereas the fifth and last factor was composed by O and ST (Table 3).

In order to evaluate the common variance of the five

Table 2
Intercorrelations between TCI-R, NEO-FFI-R and ZKPQ-50-CC

	ImpSS	N-Anx	Agg-Host	Act	Sy	N	E	O	A	C
NS. Novelty Seeking	.50	.00	.23	-.02	.29	-.04	.30	.20	-.24	-.39
HA. Harm Avoidance	-.30	.58	.12	-.24	-.29	.67	-.50	-.11	.06	-.16
RD. Reward Dependence	.18	.02	-.10	.05	.55	-.02	.52	.22	.39	.18
Ps. Persistence	.15	-.13	-.06	.52	.10	-.16	.39	.19	.02	.53
SD. Self-directiveness	-.14	-.52	-.31	.10	.11	-.55	.24	.07	.40	.58
Co. Cooperativeness	-.04	-.19	-.44	-.02	.23	-.24	.30	.29	.63	.40
ST. Self-transcendence	.30	.17	-.04	.18	.04	.13	.20	.44	-.05	-.04
ImpSS. Impulsive Sensation Seeking	—	—	—	—	—	-.02	.41	.25	-.17	-.22
N-Anx. Neuroticism-Anxiety	—	—	—	—	—	.68	-.24	.01	-.13	-.29
Agg-Host. Aggressiveness-Hostility	—	—	—	—	—	.23	-.02	-.06	-.43	-.23
Act. Activity	—	—	—	—	—	-.10	.30	.02	-.08	.25
Sy. Sociability	—	—	—	—	—	-.18	.64	.10	.11	.00

factors obtained in the PCA, five single factor models were analyzed through confirmatory factor analyses including the scales with loadings higher or equal than .50 as observed variables. In the case of the F-IV model with only three observed variables with loadings above .50, this factor was under-identified, therefore, the scale with the highest loading in the same factor found in the EFA (E which had a .33 loading in Table 3), was included in the CFA factor analysis.

Model fit criteria were: the Tucker-Lewis index (TLI) (Bentler & Bonett, 1980; Tucker & Lewis, 1973); the Expected Cross-Validation Index (ECVI) (Bollen, & Long, 1993; Browne & Cudeck, 1993); the comparative fit index (CFI) (Bentler, 1990); and the Root Mean Square Error of

Approximation (RMSEA) (Steiger, 1990). A well-fitting model should ideally have a non-significant χ^2 statistic, CFI and TLI values close to 0.95 or greater. Browne and Cudeck (1993) suggest that a value of 0.05 of the RMSEA indicates a close fit and values of up to 0.08 represent reasonable errors of approximation in the population. Table 4 shows model fit indicators for each model, together with the variables included in each model. These outcomes suggest an acceptable fit, indicating that the scales in each model are highly interrelated and define well the specified latent dimension. Notice that some personality variables were integrated in two models, because they had high secondary loadings in other factors in the exploratory factor analysis.

Table 3

Five factor Principal Component Analysis of TCI-R, NEO-FFI-R and ZKPQ-50-CC

	I	II	III	IV	V
A. Agreeableness	.83	.01	.14	-.05	-.05
Co. Cooperativeness	.82	-.13	.27	.01	.17
Agg-Host. Aggressiveness-Hostility	-.61	.21	.16	.03	-.14
N. Neuroticism.	-.16	.87	-.07	-.06	.07
N-Anx. Neuroticism-Anxiety	-.15	.84	-.01	-.03	.11
HA. Harm Avoidance	.10	.82	-.26	-.19	-.17
SD. Self-directiveness	.57	-.58	.03	.23	-.11
Sy. Sociability	.06	-.12	.85	.02	-.05
E. Extraversion	.07	-.28	.75	.33	.15
RD. Reward Dependency	.45	.16	.74	.06	.10
ImpSS. Impulsive-Sensation Seeking	-.38	-.10	.52	.03	.43
NS. Novelty Seeking	-.44	-.17	.50	-.30	.33
Ps. Persistence	.08	-.14	.09	.85	.22
Act. Activity	-.14	-.06	.11	.77	.06
C. Conscientiousness	.56	-.20	-.06	.60	-.13
O. Openness	.19	-.03	.10	.00	.80
ST. Self-Transcendence	-.03	.16	.05	.23	.79
<i>Eigenvalue.</i>	4.33	2.40	2.09	1.71	1.19
<i>% Variance.</i>	25.45	17.05	12.27	10.06	7.02

Note. Factorial loadings equal or higher to .50 in boldface.

Table 4

Goodness of fit indices for each independent factors (One-factor model) of TCI-R, NEO-FFI-R and ZKPQ-50-CC five factor solution

	χ^2 *	df	ECVI	TLI	CFI	RMSEA (90% CI)
F-I A, Co, Agg-Host, SD, C	32.26	4	.04	.96	.99	.09 (.05-.13)
F-II HA, N-Anx, N, SD	14	2	.03	.98	.99	.08 (.04-.12)
F-III Sy, E, RD, ImpSS, NS	35.38	4	.06	.94	.98	.09 (.06-.12)
F-IV Ps, Act, C, E	15.54	2	.03	.95	.98	.08 (.04-.12)
F-V O, ST, NS, ImpSS	9.16	2	.03	.91	.99	.09 (.04-.15)

Note. *The associated p values were always lower than .001. d.f. Degree of freedom; ECVI: Expected Cross-Validation Index. TLI: Tucker-Lewis index; CFI: Comparative Fit Index; RMSEA: root mean square error of approximation and its 90% confidence interval.

Discussion

The relationships amongst the personality models of Cloninger, Costa, and McCrae, and Zuckerman have been reported in different works and cross-cultural context. The current research was designed for check the relationship between the three models simultaneously.

The study was done with a sample with a wide age range, and with an equivalent proportion of males and females. The high inter-correlations amongst the three questionnaires indicate that they might be measuring equivalent constructs. Nevertheless, the principal components analyses allow for a better understanding of the associations of the 17 scales, which with a high degree of covariation might be explicated in accordance with five personality constructs.

The first factor was formed by Agreeableness, Cooperativeness, and Aggression-Hostility, and Self-Direction in a lesser extent. This construct might be considered a *Socialization* dimension. A Neuroticism dimension emerged as the second factor, composed by N from the NEO-FFI-R, N-Anx from the ZKPQ-50-CC, and Harm Avoidance from the TCI-R. This dimension could also include Self-Direction from TCI-R. It should be noted though that this last factor load positively in the previous *Socialization* factor, and in negative in the present *Neuroticism* factor. The third group of variables which were highly correlated included Extraversion and Sensation Seeking variables, thus, this factor might be named as *Extraversion-Sensation Seeking*, which was integrated by the ImpSS and Novelty Seeking from the ZKPQ-50-CC and TCI-R, respectively, which have been found to be highly correlated also in past research (Zuckerman & Cloninger, 1996). Besides, the Extraversion (NEO-FFI-R), Sy (ZKPQ-50-CC), and Reward Dependency (TCI-R) scales also loaded into this factor. The fourth factor was integrated by the Persistence scales from the TCI-R, Act from the ZKPQ-50-CC, and Conscientiousness from the NEO-FFI-R providing a construct that might be labeled as *Determination – Activity*, although Conscientiousness is also loading in the *Socialization* factor. The fifth factor was basically integrated by Openness (NEO-FFI-R) and Self-Transcendence (TCI-R) which were highly intercorrelated. Besides, the Sensation Seeking, Openness and Extraversion scales were highly intercorrelated in precedent studies (Aluja, García, & García, 2003; García, Aluja, García, & Cuevas, 2005). Furthermore, the one-factor confirmatory factor analyses indicated that the scales forming the five factors shared a relevant amount of variance, suggesting its high intertwining and that they could be measuring in fact equivalent constructs. A potential limitation of the present study is the use of the same sample for both, EFA and CFA. An alternative procedure would be to perform an EFA on half of a randomly selected sample, and then, perform the CFA on the other half (Aluja, Kuhlman, & Zuckerman, 2010; Blanch & Aluja, 2009). Nevertheless, the outcomes would be unlikely to differ from the present ones.

Another limitation of the study is that the sample used in this research is a convenience consisting of students, their friends, and their family members, therefore the outcomes of the present study may not be generalized to the population as it has been not contrasted with the census. However, sex and age range have been adequately represented in the studied sample.

The three personality models analyzed in the present study might therefore be measuring very similar personality constructs with different scales. It is clear that the Neuroticism scales, N, N-Anx and HA, are very similar indeed. Extraversion was also defined in the three models (E, Sy, RD), including Sensation Seeking and Novelty Seeking, all of them being traits related with a general Extraversion construct as suggested by Eysenck and Eysenck (1985). In addition, Agreeableness and Conscientiousness from the NEO-FFI-R and in combination with the ZKPQ-50-CC and TCI-R gave rise to two factors which may be named *Social Integration*. The first is related to friendliness (A and Agg-Host) and cooperation with others, and the other to determination and/or activity. Both were also related with Conscientiousness from the NEO-FFI-R. In addition, both factors resemble the Psychoticism Eysenck factor which included low sociability, lack of empathy, egoism, antisocial behavior or psychopathy (Eysenck, 1991, 1992a, 1992b). The Openness and Self-Transcendence scales were highly related and distinct from the rest of scales groups analyzed, although they would also be close to Extraversion and Sensation Seeking. The present study is the first one to provide a direct comparison of the three instruments measuring the three most important personality models.

References

- Aluja, A., García, O., & García, L. F. (2002). A comparative study of Zuckerman's three structural models for personality through the NEO-PI-R, ZKPQ-III, EPQ-RS and Goldberg's 50-bipolar adjectives. *Personality and Individual Differences, 33*, 713-725. doi:10.1016/S0191-8869(01)00186-6
- Aluja, A., García, O., & García, L. F. (2003). Relationships among extraversion, openness to experience, and sensation seeking. *Personality and Individual Differences, 35*, 671-680. doi:10.1016/S0191-8869(02)00244-1
- Aluja, A., García, O., Rossier, J., & García, L. F. (2005). Comparison of the NEO-FFI, the NEO-FFI-R and an alternative short version of the NEO-PI-R (NEO-60) in Swiss and Spanish samples. *Personality and Individual Differences, 38*, 591-604. doi:10.1016/j.paid.2004.05.014
- Aluja, A., Kuhlman, M., & Zuckerman, M. (2010). Development of the Zuckerman-Kuhlman-Aluja Personality Questionnaire (ZKA-P): A factor/facet version of the Zuckerman-Kuhlman Personality Questionnaire (ZKPQ). *Journal of Personality Assessment, 92*, 416-431. doi:10.1080/00223891.2010.497406

- Aluja, A., Rossier, J., García, L. F., Angleitner, A., Kuhlman, M., & Zuckerman, M. (2006). A cross-cultural shortened form of the ZKPQ (ZKPQ-50-CC) adapted to English, French, German, and Spanish languages. *Personality and Individual Differences*, *41*, 619-628. doi:10.1016/j.paid.2006.03.001
- Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin*, *107*, 238-246. doi:10.1037//0033-2909.107.2.238
- Bentler, P. M., & Bonett, D. G. (1980). Significance tests and goodness of fit in the analysis of covariance structures. *Psychological Bulletin*, *88*, 588-606. doi:10.1037/0033-2909.88.3.588
- Blanch, A., & Aluja, A. (2009). Validation study of the Spanish Version of the Work-Family Conflict Questionnaire (CCTF). *Spanish Journal of Psychology*, *12*(2), 746-755.
- Bollen, K. A., & Long, J. S. (1993). *Testing structural equation models*. New York, NY: Sage.
- Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. Bollen and J. S. Long (eds.), *Testing structural equation models* (pp. 136-162). London: SAGE.
- Cloninger, C. R. (1986). A unified biosocial theory of personality and its role in the development of anxiety states. *Psychiatric Developments*, *3*, 167-226.
- Cloninger, C. R. (1987). A systematic method for clinical description and classification of personality variants. *Archives of General Psychiatry*, *44*, 573-588.
- Cloninger, C. R., & Svrakic, D. M. (1997). Integrative psychobiological approach to psychiatric assessment and treatment. *Psychiatry*, *60*, 120-141.
- Cloninger, C. R., Svrakic, D. M., & Przybeck, T. R. (1993). A psychobiological model of temperament and character. *Archives of General Psychiatry*, *50*, 975-990.
- Cohen, J. (1988). *Statistical power analysis for the behavioural sciences*. New Jersey, NJ: Lawrence Erlbaum Associates, Inc.
- Costa Jr., P. T., & McCrae, R. R. (1992). *Professional manual: Revised NEO personality inventory (NEO-PI-R) and NEO five-factor-inventory (NEO-FFI)*. Odessa, FL: Psychological Assessment Resources.
- De Fruyt, F., Van De Wiele, L., & Van Heeringen, C. (2000). Cloninger's psychobiological model of Temperament and Character and the Five-Factor model of personality. *Personality and Individual Differences*, *29*, 441-452.
- Digman, J. M. (1990). Personality structure: emergence of the Five-Factor Model. *Annual Review of Psychology*, *41*, 417-440. doi:10.1146/annurev.ps.41.020190.002221
- Eysenck, H. J. (1991). Dimensions of personality, 16, 5 or 3?-Criteria for a taxonomic paradigm. *Personality and Individual Differences*, *12*, 773-790.
- Eysenck, H. J. (1992a). Four ways five factor are not basic. *Personality and Individual Differences*, *13*, 667-673. doi:10.1016/0191-8869(92)90237-J
- Eysenck, H. J. (1992b). A replay to Costa and McCrae. P or A and C-the role of theory. *Personality and Individual Differences*, *13*, 867-868. doi:10.1016/0191-8869(92)90003-8
- Eysenck, H. J., & Eysenck, M. W. (1985) *Personality and Individual Differences*. New York, NY: Plenum Press.
- Farmer, F., & Goldberg, L. R. (2008). A psychometric evaluation of the revised temperament and character inventory (TCI-R) and de TCI-140. *Psychological Assessment*, *20*, 281-291. doi:10.1037/a0012934
- García, L. F., Aluja, A., García, O., & Cuevas, L. (2005). Is openness to experience an independent personality dimension? convergent and discriminant validity of the openness domain and its NEO-PI-R facets. *Journal of Individual Differences*, *26*, 132-138. doi:10.1027/1614-0001.26.3.132
- Goldberg, L. R. (1981). Language and individual differences: the search for universals in personality lexicons. In L. Wheeler, *Review of Personality and Social Psychology* (Vol. 2, pp. 141-165). Beverly Hills, CA: Sage.
- Goldberg, L. R. (1990). An alternative "description of personality": the Big Five factor structure. *Journal of Personality and Social Psychology*, *59*, 1216-1229. doi:10.1037//0022-3514.59.6.1216
- Gutierrez-Zotes, J. A., Bayón, C., Montserrat, C., Valero, J., Labad, A., Cloninger, C. R., & Fernandez-Aranda, F. (2004). Temperament and Character Inventory Revised (TCI-R). Standardization and normative data in a general population sample. *Actas Españolas de Psiquiatría*, *32*, 8-15.
- Joireman, J., & Kuhlman, D. M. (2004). The Zuckerman-Kuhlman Personality Questionnaire: Origin, development, and validity of a measure to assess an alternative Five-Factor Model of personality. In R. M. Stelmack (Ed.), *On the psychobiology of personality: Essays in honor of Marvin Zuckerman* (pp. 49-64). New York, NY: Elsevier Science. doi:10.1016/B978-008044209-9/50005-1
- Kaiser, H. F. (1961). A note on Guttman's lower bound for the number of common factors'. *British Journal of Statistical Psychology*, *14*, 1-2.
- Maitland, S. B., Nyberg, L., Bäckman, L., Nilson, L. G., & Adolfsson, R. (2009). On the structure of personality: Are there separate temperament and character factors? *Personality and Individual Differences*, *47*, 180-184. doi:10.1016/j.paid.2009.02.023
- McCrae, R. R., Terracciano, A., & 78 Members of the Personality Profiles of Cultures Project (2005). Universal features of personality traits from observer's perspective: Data from 50 cultures. *Journal of Personality and Social Psychology*, *88*, 547-561. doi:10.1037/0022-3514.88.3.547
- McCrae, R. R., & Costa, P. T. (1985). Comparison of EPI and psychoticism scales with measures of the five-factor model of personality. *Personality and Individual Differences*, *6*, 587-597. doi:10.1016/0191-8869(85)90008-X
- McCrae, R. R., & Costa, P. T. (2004). A contemplated revision of the NEO Five-Factor Inventory. *Personality and Individual Differences*, *36*, 587-596. doi:10.1016/S0191-8869(03)00118-1
- Norman, W. T. (1967). *2800 personality trait descriptors: normative operating characteristics for a university population*. Michigan, MI: University of Michigan, Department of Psychology.
- Steiger, J. H. (1990). Structural model evaluation and modification: An interval estimation approach. *Multivariate Behavioral Research*, *25*, 173-180. doi:10.1207/s15327906mbr2502_4

- Tucker, L. R., & Lewis, C. (1973). A reliability coefficient for maximum likelihood factor analysis. *Psychometrika*, *38*, 1-10. doi:10.1007/BF02291170
- Tupes, E. C., & Christal, R. C. (1961). *Recurrent personality factors based on trait ratings* (Tech. Rep. No. ASD-TR-61-97). Lackland Air Force Base, TX: US Air Force.
- Zuckerman, M. (2002). Zuckerman-Kuhlman Personality Questionnaire (ZKPQ): An alternative five-factorial model. In B. de Raad & M. Perugini (Eds.), *Big Five assessment* (pp. 377-396). Göttingen: Hogrefe & Huber Publishers.
- Zuckerman, M. (2008). Zuckerman-Kuhlman Personality Questionnaire (ZKPQ): An operational definition of the Alternative Five Factorial Model of Personality. In G. J. Boyle, G. Matthews, & D. H. Saklofske (Eds.), *The SAGE handbook of personality theory and assessment* (Vol. 2, pp. 219-238). Thousand Oaks, CA: Sage Publications, Inc.
- Zuckerman, M., & Cloninger, C. R. (1996). Relationships between Cloninger's, Zuckerman's, and Eysenck's dimensions of personality. *Personality and Individual Differences*, *21*, 283-285. doi:10.1016/0191-8869(96)00042-6
- Zuckerman, M., Kuhlman, D. M., Teta, P., Joireman, J., & Kraft, M. (1993). A comparison of three structural models of personality: The big three, the big five, and the alternative five. *Journal of Personality and Social Psychology*, *65*, 757-768. doi:10.1037/0022-3514.65.4.757
- Zuckerman, M., Kuhlman, D. M., Thornquist, M., & Kiers, H. (1991). Five (or three) robust questionnaire scale factors of personality without culture. *Personality and Individual Differences*, *12*, 929-941. doi:10.1016/0191-8869(91)90182-B

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