ISSN 1697-2600
2008, Vol. 8, Nº 1, pp. 203-217

International Journal of IJCHP Clinical and Health Psychology

Psychometric properties of the French version of the Zuckerman-Kuhlman Personality Questionnaire[1]

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(Received June 5, 2006/ Recibido 5 de junio 2006)
(Accepted April 2, 2007/ Aceptado 2 de abril 2007)

ABSTRACT. This instrumental study was designed to investigate the psychometric properties of the French version and the cross-language replicability of the Zuckerman-Kuhlman Personality Questionnaire (ZKPQ) at the factor- and at the facet-level. The ZKPQ is an instrument aimed at assessing the five basic factors of Zuckerman's Alternative Five-Factor Model (AFFM). Subjects were 843 French-speaking Swiss, mainly students. At the factor-level, the reliability ranged from .73 to .87 and at the facet level, the reliability ranged from .57 to .77. Differences between genders are congruent with those found in the American sample. Women scored higher on N-Anx, and lower on ImpSS, and Act. A series of exploratory factor analyses supported the overall five-factor structure and the structure at the facet-level. The correlations among the scales support that the five basic factors of the AFFM are orthogonal. Targeted factor analyses and congruence coefficients show high cross-language replicability at the factor- and at the facet-level. The adequacy of the model at the factor- and facet-level was tested using confirmatory factor analyses. The results show that the French version of the ZKPQ is a reliable and valid instrument and has a high cross-language replicability.

[1] We thank Marvin Zuckerman for correcting the back-translation of the French version of the ZKPQ and for providing the American loading matrices. This research was supported by a fellowship from the University of Lleida to Anton Aluja.

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KEYWORDS. Personality assessment. Alternative Five-Factor Model. ZKPQ. Cross-language replicability. Instrumental study.

RESUMEN. Este estudio instrumental fue diseñado para investigar las propiedades psicométricas de la versión francesa y replicabilidad transcultural del *Zuckerman-Kuhlman Personality Questionnaire* (*ZKPQ*) en sus factores y facetas. El *ZKPQ* es un instrumento destinado a evaluar los cinco factores básicos del *Alternative Five-Factor Model* (*AFFM*). Los participantes fueron 843 suizos francófonos, principalmente estudiantes universitarios. Obtenidos los factores estos mostraron una fiabilidad entre 0,73 y 0,87, y sus facetas entre 0,57 y 0,77. Las diferencias entre géneros son similares a las informadas en la muestra americana. Las mujeres alcanzaron puntuaciones superiores en *N-Anx*, y puntuaciones más bajas en *ImpSS* y *Act*. El resultado de los análisis factoriales exploratorios respaldó la estructura de cinco factores y sus correspondientes facetas. Las correlaciones entre las escalas sostienen que los cinco factores básicos del *AFFM* son ortogonales. Los coeficientes de congruencia muestran la elevada replicabilidad transcultural de los factores y sus facetas. Se puso a prueba el ajuste del modelo en sus factores y facetas mediante análisis factorial confirmatorio. Los resultados indican que la versión en lengua francesa del *ZKPQ* es un instrumento fiable y válido y posee buena replicabilidad transcultural.

PALABRAS CLAVE. Evaluación de la personalidad. El modelo de cinco factores alternativo. *ZKPQ*. Replicabilidad transcultural. Estudio instrumental.

The Zuckerman-Kuhlman Personality Questionnaire (ZKPQ) was developed in order assess the five basic dimensions of the Alternative Five-Factor Model (AFFM) proposed by Zuckerman and colleagues (Zuckerman, Kuhlman, Joireman, Teta, and Kraft, 1993; Zuckerman, Kuhlman, Thornquist, and Kiers, 1991). The aim of this research was to study the psychometric properties of the French version of the ZKPQ. A special attention was paid to the cross-language replicability at the factor-level and at the facet-level.

The original Five-Factor Model (FFM) was developed by adding to a three-factor model made up of Neuroticism, Extraversion, and Openness to Experience (Costa, McCrae, and Arenberg, 1980) two factors, Agreeableness and Conscientiousness (McCrae and Costa, 1985). These factors are similar to the Big Five identified in numerous lexical studies starting with Fiske (1949), Tupes and Christal (1961) until very nowadays (De Raad, 2000; Goldberg, 1992). The FFM found increasing support and is now the most common dimensional approach to personality traits (Digman, 1990; Rossier, Meyer de Stadelhofen, and Berthoud, 2004). Five-Factor Theory (FFT) claims that personality traits are biologically rooted (McCrae and Costa, 1999) and several studies have shown that the heritability of these five dimension is high (McCrae, Jang, Livesley, Riemann, and Angleitner, 2001). Moreover, these five factors are very stable across cultures (Rolland, 2002; Rossier, 2005; Rossier, Dahourou, and McCrae, 2005). However, numerous researches on the biological correlations of personality traits used other dimensions,

such as sensation seeking or impulsivity, which are not well represented in the FFM according to Zuckerman and colleagues' opinion (Zuckerman, Kuhlamn, and Camac, 1988).

To develop their AFFM, Zuckerman *et al*. (1988) studied the structure underlying 46 scales selected from 8 tests, which had been used as measures of temperament or involved in psychobiological studies of personality such as the Buss and Plomin (1975; EASI-III), or the sensation seeking (Zuckerman, 1979; SSSV) scales. They expected that these scales would provide markers for seven orthogonal factors. However, after a series of factor analyses extracting respectively, three, five, or seven factors, only five factors of the expected seven were found. This five-factor solution was made up of an Activity, Neuroticism-Emotionality, Sociability, Impulsive-Unsocialized-Sensation Seeking, and Aggressive Sensation-Seeking factor. The three-factor solution was similar to Eysenck's three-dimensional model (Eysenck and Eysenck, 1985). His Extraversion, Psychoticism, and Neuroticism scale had very high loading on respectively the first, second, and third factor (.86, .60, and .75). In a second study done in order to define more precisely these basic dimensions, Zuckerman and colleagues (1991) conducted a series of factor analyses on 33 scales from seven tests out of the eight used in the first study (Zuckerman *et al*., 1988). They successively considered three, four, five, six, and seven factors. The three- and the five-factor solutions were the two most robust one. They decided to proceed with five-factor solution offering more specificity. The five considered dimensions were the following: Impulsive-Unsocialized Sensation Seeking, Neuroticism-Anxiety, Aggression-Hostility, Activity, and Sociability.

Zuckerman and colleagues (1993) developed a questionnaire aiming in measuring specifically the five dimensions of the AFFM. They selected twenty items for each factor scale on the basis of two criteria, high correlation with one factor and low correlations on the others, and low correlation with the Crowne-Marlowe (1960) Social Desirability scale. Many items were rewritten and a principal component analysis with varimax rotation allowed extracting five factors. 89 items out of the hundred studied loaded at least .30 on their factor and sufficiently higher on that factor than on any of the other four. Ten items were added in order to provide an Infrequency scale. The final version of the ZKPQ was made up of 99 items measuring the following basic five dimensions: Impulsive Sensation Seeking (ImpSS) involving a lack of planning and a tendency to act without thinking, Neuroticism-Anxiety (N-Anx) involving a tendency feel upset, fear, and anxiety, Aggression-Hostility (Agg-Host) involving aggressive, rude or antisocial behaviors, Activity (Act) involving a need for activity and hard work, Sociability (Sy) involving a preference for social activities and being with others. The Infrequency (Inf) scale assesses excessive concern with appearing socially desirable (Zuckerman *et al*., 1993, pp. 759-760). The results of the validation study of this final version indicate a clear five-factor solution with orthogonal dimensions. Indeed, correlations between these dimensions are very low (r = .37). Globally, the alpha coefficient reliabilities ranged from .72 to .86. Retest reliabilities were also satisfactory ranging from .76 to .84. Women scored significantly and systematically higher on N-Anx. Zuckerman (2002) also suggest considering facet scores for three out of the five basic dimensions. The ImpSS scale contains a Sensation Seeking and an Impulsivity

facet. The Act scale contains a need for General Activity and a need for Work Activity facet. The Sy scale contains a liking lively Parties and Friends and an Intolerance of social Isolation facet.

The ZKPQ was translated in several languages: German (Ostendorf and Angleitner, 1994), Japanese (Shiomi *et al*., 1996), Chinese (Wu *et al*., 2000), Italian (De Pascalis and Russo, 2003), Spanish (Herrero, Viña, González, Ibáñez, and Peñate, 2001), and Catalan (Gomà-i-Freixanet, Valero, Punt, and Zuckerman, 2004). The validity studies of all these translations allowed extracting the expected five dimensions in each case. The psychometric properties generally indicated that these translations are valid and reliable versions of the ZKPQ. Correlations between the scales were always low suggesting a good cross-language replicability. Gomà-i-Freixanet and colleagues (2004) made a first systematic study of the structural replicability comparing the structure obtained in their Catalan sample to the U.S. structure for women and men. For women, the replicability was high for N-Anx, Sy, and Act, and borderline for ImpSS and Agg-Host. For men, the replicability was high for N-Anx, ImpSS, Act, and Sy, and borderline for Agg-Host. However, they did not consider the facet-level and didn't report the congruencies for items. Three short-versions of the ZKPQ were also proposed. Zuckerman and Kuhlman developed a short form (ZKPQ-S) made up of 35 items, selected according to their correlations with the basic factors. Some items were eliminated because of the redundancy of content (Zuckerman, 2002). Aluja, García, and García (2003) proposed a 69-item version of the ZKPQ. The aim of their study was to increase the psychometric properties of the ZKPQ by deleting items, which did not contribute sufficiently to the basic factors based on results of exploratory and confirmatory factor analyses. Recently, Aluja and colleagues (2006) proposed a third shortened form, the ZKPQ-50-CC, made up of 50 items selected according to their factor loading and to their cross-language stability.

Several studies compared the AFFM with other dimensional models. Zuckerman and Cloninger (1996) studied the relation between the ZKPQ and the Temperament and Character Inventory (TCI; Cloninger, Przybeck, Svrakie, and Wetzel, 1994). They observed that the ImpSS correlated with TCI Novelty Seeking scale, that N-Anx correlated with Harm Avoidance, that Agg-Host correlated negatively with Cooperativeness, and that Act correlated with Persistence. They concluded that the ZKPQ showed a good convergent validity with four TCI scales. Aluja, García, and García (2002) compared the AFFM with Eysenck's three-factor model using the EPQ and with the FFM using the NEO-PI-R. They observed that ImpSS correlated negatively with NEO-PI-R Conscientiousness scale and positively with EPQ Psychoticism scale. N-Anx correlated positively with NEO-PI-R Neuroticism scale and with EPQ Neuroticism scale. Agg-Host correlated negatively with NEO-PI-R Agreeableness. They concluded that the convergence among the various scales is high but that the NEO-PI-R Openness scale is only poorly represented in the ZKPQ and that the ZKPQ Activity scale is only poorly represented in the NEO-PI-R.

The aim of this instrumental study (Carretero-Dios and Pérez, 2007; Montero and León, 2007) is to analyze the psychometric properties of the French version of the ZKPQ. For this reason, the structural validity calculating internal consistencies and using principal component analyses, the cross-language replicability using procrustes

rotation and calculating congruence coefficients, and the construct validity using confirmatory factor analysis will be analyzed at the factor-level and at the facet-level. The purpose of this study is to provide a well-adapted, valid, and reliable instrument that allow for personality research in French based on the AFFM proposed by Zuckerman, but also to assess the cross-language replicability of the AFFM.

Method

Subjects

The sample consisted of 843 Swiss French-speaking young adults (514 females and 329 males). The mean age was 23.06 for women (*SD* = 6.96) and 25.01 for men (*SD* = 8.97). 80.9% of the subjects were 25 years old or younger (*n* = 682), 10.4% were between 26 and 35 years old (*n* = 88), 7.8% were 36 or older (*n* = 66), and 0.8% did not indicate their age (*n* = 7). The sample was mostly made up of social sciences students, their friends and relatives.

Instruments

The French version of the Zuckerman-Kuhlman Personality Questionnaire (ZKPQ) is made up 99 true-false items and measures the following dimensions: Impulsive Sensation Seeking (ImpSS), Neuroticism-Anxiety (N-Anx), Aggression-Hostility (Agg-Host), Activity (Act), Sociability (Sy), and Infrequency (Inf) that is a control scale used to eliminate subjects with possibly invalid records. ImpSS and N-Anx are made up 19 items, Agg-Host, Act and Sy are made up 17 items and Inf made up 10 items. In our study 8.6 % of the subjects get scores higher than 4 in the Inf scale. Zuckerman (2002) suggests that three of the five major scales can be divided into facets scales. ImpSS is made up of two facets: (a) Sensation Seeking (SS), and (b) Impulsivity especially of the non-planning type (Imp). Act is made up two facets: (a) need for General Activity (GA), and (b) need for Work Effort (WE). Finally, Sy is made up of two facets: (a) liking lively Parties and Friends (PF), and (b) Intolerance of social Isolation (II).

All 99 ZKPQ's items were translated into French and blindly back translated into English by a professional translator and checked by the authors of the questionnaire. Amendments were translated into French and reviewed. This process continued until the translation and back translation agreed.

Procedure

The subjects completed the French version of the ZKPQ. The questionnaires were administered anonymously in classroom setting by group of 20 or administered individually. All subjects were recruited by students and didn't get any pay back for their participation but they could get an individual descriptive feedback. This research complies with the ethical rules of the American Psychological Association (APA).

Results

Descriptives, alpha coefficients and comparisons by sex

Table 1 summarizes means, standard deviations, kurtosis, skewness, and alphas for the total sample and for women and men. The internal consistencies measured with alphas are adequate and similar to those found in the American sample. For the five global scales alphas ranged from .73 to .87. For women the internal consistencies ranged from .71 to .86 and for men from .74 to .83. The alphas of the facet-scales ranged from .59 to .76. For women the internal consistencies of the facet-scales ranged from .59 to .77 and for men from .57 to .74. These results are slightly lower than those found in the American sample. The kurtosis and skewness values indicated that the distributions are normal and symmetrical, for the five main scales and for the facets (all values below 1). We analysed the gender differences and found that women have significantly higher scores on N-Anx and significantly lower scores on ImpSS, Act, and Inf, than men. An analysis at the facet-level showed that women have significantly lower scores on SS, WE and PF, and higher scores on II than men (see Table 1).

TABLE 1. Descriptives, *t*-tests comparisons by sex and alpha coefficients.

	Women			*Men*						
ZKPQ	α	*Mean*	*SD*	α	*Mean*	*SD*	*t-test*	α	*Kurtosis*	*Skewness*
ImpSS	.80	8.98	4.19	.77	9.87	3.99	3.01**	.79	-.04	-.71
SS	.77	6.50	3.05	.74	7.33	2.92	3.87***	.76	-.23	-.83
Imp	.66	2.48	1.85	.59	2.53	1.76	.35	.63	.42	-.67
N-Anx	.86	10.25	4.72	.83	6.40	4.16	-12.03***	.87	.18	-.90
AggHost	.71	6.84	3.17	.75	7.08	3.43	1.05	.73	.11	-.63
Act	.76	6.57	3.49	.74	7.30	3.40	3.07**	.76	.28	-.58
GA	.75	2.68	2.31	.71	2.84	2.23	1.06	.73	.63	-.56
WE	.59	3.89	1.85	.57	4.46	1.81	4.50***	.59	-.19	-.63
Sy	.75	8.54	3.51	.79	8.47	3.81	-.26	.76	-.15	-.62
PF	.70	3.88	2.16	.71	4.35	2.30	3.06**	.71	-.01	-.78
II	.67	4.67	2.10	.71	4.11	2.21	-3.69***	.68	-.20	-.85
Inf	.47	1.81	1.54	.44	2.62	1.67	7.16***	.48	.83	.79

Note. ImpSS: Impulsive Sensation Seeking; SS: Sensation Seeking; Imp: Impulsivity; N-Anx: Neuroticism-Anxiety; AggHost: Aggression-Hostility; Act: Activity; GA: General Activity; WE: Work Effort; Sy: Sociability; PF: Parties and Friends; II: Intolerance of social Isolation; Inf: Infrequency.

$^{*}p < .05$;$^{**}p < .01$;$^{***}p < .001$

Exploratory factor analysis

A principal components exploratory factor analysis with varimax rotation of the 89 items (excluding items from the Infrequency scale) allowed extracting five factors using Cattell's criterion. These factors explained 27.06% of the total variance. The first six eigenvalues were 7.49, 5.97, 4.19, 3.46, 2.97, and 2.21. Most items loaded in the expected factor but some items had secondary loadings higher than .30: items 28 (Act) and 53 (Sy) loaded also on ImpSS (F2); item 43 (Sy) loaded also on N-Anx (F1); items

14 (ImpSS), 89 (ImpSS), and 99 (Act) loaded also on AggHost (F4); and items 1 and 29 (ImpSS) loaded also on Act (F3) (see Table 2). A one-to-one association was observed between the five factors and the five main scales of the ZKPQ. Factor 1 was associated with N-Anx, factor 2 with ImpSS, factor 3 with Act, factor 4 with Agg-Host, and factor 5 with Sy (see Table 3). The inter-correlations between the five dimensions of the ZKPQ are very low and range from -.14 to .22.

TABLE 2. Results of the principal component analysis: Swiss and American matrices after varimax rotation, and Swiss matrix after procrustes rotation.

	Swiss matrix					*American matrix*					*Procrustes rotation*					
Items	F1	F2	F3	F4	F5	F1	F2	F3	F4	F5	F1	F2	F3	F4	F5	CC
1	.16	**.38**	*-.39*	.06	-.07	.03	**.36**	-.27	-.07	.02	.14	**.41**	*-.38*	-.06	.03	.98
6	.06	**.33**	-.26	.11	.03	-.03	**.35**	-.23	-.05	.05	.05	**.35**	-.24	.04	.09	.96
14	.09	**.41**	.05	*.38*	-.04	-.04	**.61**	.00	.01	.06	.11	**.43**	.07	-.04	*.35*	.80
19	-.06	**.32**	-.28	.05	-.05	-.04	**.44**	*-.32*	-.09	.04	-.07	**.34**	-.26	-.04	.04	.99
24	-.13	**.50**	.13	.02	.17	-.13	**.39**	.10	.13	.02	-.13	**.49**	.16	.18	.00	.99
29	.06	**.42**	*-.42*	.04	-.05	-.02	**.41**	*-.33*	-.07	.06	.04	**.44**	*-.40*	-.04	.02	.99
34	-.01	**.48**	-.08	-.07	-.04	.00	**.43**	-.10	-.06	-.03	-.03	**.48**	-.06	-.02	-.10	.98
39	-.15	**.59**	.12	.03	-.08	-.16	**.50**	.09	.09	-.01	-.15	**.58**	.16	-.06	.00	.96
45	-.08	**.36**	-.08	.03	.19	-.05	**.46**	.12	.14	.05	-.08	**.36**	-.06	.20	.02	.90
50	.25	**.27**	-.08	.10	-.11	.20	**.34**	.00	.02	.07	.25	**.29**	-.08	-.11	.06	.92
55	-.07	**.54**	.07	.09	.06	-.10	**.43**	.07	.06	.05	-.07	**.54**	.10	.07	.06	.99
60	-.04	**.47**	.22	-.01	.00	-.02	**.41**	.15	.01	.02	-.04	**.46**	.24	.01	-.04	.98
65	.05	**.49**	.20	-.04	.15	-.02	**.43**	.19	.01	.03	.05	**.47**	.22	.16	-.07	.93
70	-.03	**.56**	.07	.15	.03	-.06	**.45**	.13	.17	.13	-.03	**.56**	.10	.04	.12	.96
75	-.09	**.39**	.03	-.06	-.27	-.08	**.38**	.16	-.27	.00	-.10	**.39**	.05	-.26	-.09	.96
79	.05	**.42**	.04	-.02	.14	-.01	**.47**	.08	.10	.08	.03	**.41**	.06	.15	-.04	.95
84	-.01	**.50**	.12	.08	.04	.11	**.47**	.02	.06	.13	-.01	**.50**	.15	.05	.05	.93
89	.15	**.32**	.13	*.47*	-.01	.01	**.61**	.07	.02	.13	.18	**.34**	.15	-.02	*.44*	.73
95	-.09	**.46**	-.06	.16	.27	-.11	**.46**	.06	.28	.20	-.08	**.46**	-.02	.28	.15	.98
2	**.49**	-.18	.13	.12	.06	**.45**	-.22	.00	.07	-.01	**.51**	-.17	.10	.04	.09	.96
7	**.65**	-.03	-.19	-.09	-.06	**.47**	.04	-.26	-.11	-.11	**.63**	-.01	-.22	-.07	-.13	.98
15	**.51**	.19	.09	.24	.00	**.42**	.20	.09	-.08	.11	**.53**	.21	.08	-.01	.19	.98
20	**.31**	-.12	.01	.14	.07	**.36**	-.05	.06	.07	.12	**.32**	-.11	-.01	.06	.13	.97
25	**.62**	.03	.04	.17	-.03	**.51**	.05	.08	-.11	.13	**.63**	.05	.02	-.04	.12	.98
30	**.63**	.01	.00	.10	-.05	**.61**	-.03	.00	-.08	.15	**.63**	.03	-.03	-.06	.05	.98
35	**.57**	-.11	.00	.07	.04	**.60**	-.10	.01	-.02	-.02	**.58**	-.10	-.03	.03	.04	.99
41	**.54**	-.19	-.11	.07	.02	**.45**	-.20	-.04	.08	-.03	**.54**	-.17	-.14	.01	.03	.96
46	**.61**	-.07	-.02	.08	.06	**.54**	-.07	.01	.03	.04	**.61**	-.06	-.05	.05	.04	.99
51	**.57**	.07	-.07	-.08	-.12	**.58**	.02	-.16	-.05	-.10	**.56**	.08	-.09	-.12	-.13	.98
56	**.41**	-.01	.01	.08	.10	**.43**	.01	.01	-.06	.09	**.42**	.00	-.01	.09	.05	.94
61	**.67**	-.03	-.20	-.06	-.09	**.64**	.01	-.22	-.06	-.12	**.65**	-.01	-.23	-.10	-.11	1
66	**.55**	-.15	.11	.16	.01	**.57**	-.14	.06	.06	.02	**.57**	-.14	.08	-.01	.13	.98
71	**.43**	.06	-.16	.00	-.01	**.47**	.03	-.13	.12	-.05	**.42**	.08	-.18	-.01	-.03	.95
76	**.41**	-.05	.07	.06	-.05	**.47**	.02	.00	-.14	.10	**.42**	-.04	.05	-.06	.03	.96
80	**.57**	-.01	-.01	.06	-.03	**.56**	-.03	-.01	.00	.04	**.57**	.00	-.03	-.04	.02	.99
85	**.55**	-.19	.04	.14	.06	**.53**	-.18	.00	.01	.09	**.56**	-.18	.01	.04	.11	1
90	**.59**	.08	-.11	.00	-.18	**.57**	.06	-.02	-.23	.07	**.58**	.10	-.13	-.18	-.05	.96
96	**.38**	.06	.05	.08	-.09	**.43**	.01	-.03	.04	.03	**.38**	.08	-.06	-.10	.05	.93
3	-.05	.10	-.05	**.31**	-.03	.04	.11	-.06	-.05	**.32**	-.03	.12	-.04	-.04	**.31**	.97
8	.10	.06	-.05	**.52**	-.01	.16	.08	.01	.04	**.54**	.13	.10	-.04	-.03	**.51**	.99

	Swiss matrix					*American matrix*						*Procrustes rotation*					
Items	F1	F2	F3	F4	F5	F1	F2	F3	F4	F5		F1	F2	F3	F4	F5	CC
11	.04	.00	-.10	**.48**	-.01	.07	.15	-.07	.15	**.42**		.07	.03	-.09	-.03	**.48**	.90
16	.09	.07	-.12	**.20**	.05	.00	.10	-.09	.08	**.27**		.10	.09	-.12	.05	**.19**	.91
21	.15	.07	-.03	**.41**	-.08	.12	.12	-.06	-.05	**.44**		.18	.10	-.03	-.09	**.39**	.98
31	.10	-.06	.01	**.30**	.05	.06	-.11	-.08	.01	**.40**		.12	-.04	.01	.04	**.30**	.94
36	.16	.07	-.05	**.21**	-.07	.12	.10	.05	-.02	**.23**		.17	.09	-.05	-.08	**.19**	.89
42	-.28	.12	.13	**.43**	.15	-.19	.09	.13	.04	**.55**		-.24	.13	.16	.14	**.44**	.96
47	-.19	-.04	.08	**.31**	.13	-.22	.03	.12	.05	**.50**		-.16	-.03	.09	.12	**.33**	.97
57	.04	.04	-.12	**.48**	-.01	.03	.12	-.14	.16	**.41**		.07	.07	-.11	-.02	**.47**	.91
62	.06	-.17	-.06	**.34**	-.02	.03	-.19	-.05	-.02	**.39**		.08	-.14	-.07	-.04	**.34**	.98
67	.13	.08	-.02	**.42**	.01	.08	.09	.06	-.04	**.49**		.16	.11	-.01	.00	**.40**	.96
72	.21	.00	.09	**.55**	-.01	.11	.10	.12	-.10	**.52**		.25	.03	.09	-.03	**.53**	.96
77	-.01	.04	.14	**.50**	-.01	.03	.07	-.01	-.01	**.59**		.03	.06	.15	-.03	**.49**	.95
86	.03	-.05	.02	**.54**	.02	.02	-.03	-.08	.06	**.50**		.07	-.02	.02	.00	**.54**	.97
91	.06	.03	.02	**.31**	-.04	.11	.12	.02	-.14	**.44**		.08	.05	.02	-.05	**.30**	.99
97	-.02	.06	.03	**.52**	.10	-.01	.03	-.03	.13	**.53**		.02	.09	.04	.08	**.52**	.98
5	.03	.02	**.55**	.05	.00	.06	-.05	**.48**	-.11	-.04		.06	.00	**.55**	-.01	.04	.96
13	-.14	.16	**.46**	.06	-.01	.02	.05	**.49**	.01	.02		-.12	.14	**.47**	-.01	.05	.94
18	-.18	.03	**.39**	-.13	-.27	-.10	.03	**.44**	-.18	-.13		-.18	.01	**.39**	-.27	-.13	.97
23	-.23	-.17	**.36**	-.11	.03	-.25	-.11	**.32**	.13	-.02		-.22	-.20	**.36**	.03	-.09	.94
28	-.23	*.37*	**.33**	-.02	-.06	-.16	.14	**.40**	-.04	-.08		-.22	.35	**.36**	-.05	-.03	.91
33	.11	.08	**.65**	-.04	.12	.11	.11	**.58**	.16	-.02		.13	.04	**.65**	.12	-.06	.99
38	.04	.00	**.23**	.04	-.04	.03	-.04	**.42**	.01	.01		.05	-.01	**.23**	-.04	.03	.96
44	.10	.09	**.62**	.05	.15	.11	.03	**.53**	.11	.02		.13	.06	**.62**	.14	.03	1
49	.02	-.20	**.25**	-.05	-.09	-.04	-.22	**.27**	-.07	-.08		.03	-.21	**.24**	-.10	-.05	.97
54	.21	.05	**.32**	.23	-.06	*.31*	.00	**.34**	-.02	.08		.24	.05	**.32**	-.07	.20	.94
59	-.11	.12	**.42**	-.15	.04	-.16	.16	**.32**	.01	-.04		-.10	.09	**.43**	.05	-.15	.93
64	-.08	.21	**.42**	.05	-.08	-.05	.11	**.41**	-.03	.04		-.06	.19	**.43**	-.08	.03	.98
74	.02	-.02	**.54**	-.04	.00	.05	.01	**.48**	-.10	-.08		.04	-.05	**.54**	-.01	-.05	.97
83	.12	.12	**.68**	-.03	.12	.13	.04	**.67**	.12	-.04		.15	.08	**.68**	.12	-.05	1
88	-.09	.06	**.23**	.02	-.13	-.07	.06	**.18**	-.06	.02		-.08	.05	**.24**	-.13	.01	.98
94	-.18	-.03	**.47**	.05	.05	-.11	.04	**.47**	.14	-.03		-.15	-.05	**.48**	.05	.06	.95
99	.22	.06	**.13**	*.45*	.06	*.35*	.01	**.26**	-.09	.22		.26	.08	**.13**	.04	*.43*	.83
9	-.21	.16	.23	.12	**.36**	-.19	.17	.26	**.38**	.15		-.19	.14	.25	**.36**	.13	1
12	.03	-.06	-.14	.02	**.54**	.01	-.05	-.08	**.51**	-.01		.04	-.07	-.14	**.54**	.04	.99
17	.16	-.20	-.04	.00	**.54**	.03	-.19	-.04	**.49**	-.04		.17	-.21	-.05	**.53**	.02	.97
22	-.02	.17	-.01	.03	**.50**	-.01	.12	.05	**.48**	.01		-.01	.16	.00	**.50**	.04	.99
27	-.09	.13	.25	.21	**.24**	-.08	.24	.21	**.17**	.22		-.06	.12	.26	**.24**	.21	.94
37	.00	.18	.08	.01	**.48**	.10	.12	.06	**.42**	.01		.01	.16	.09	**.48**	.01	.98
43	*-.34*	.12	.11	.00	**.46**	-.25	.21	.14	**.44**	.15		*-.33*	.10	.13	**.47**	.03	.95
48	-.18	.26	.16	.02	**.42**	-.16	.24	.22	**.46**	.09		-.17	.24	.18	**.43**	.03	.99
53	.00	*.37*	-.07	.06	**.26**	-.01	*.38*	-.04	**.29**	.16		.00	*.37*	-.05	**.27**	.05	.98
58	.01	.18	-.28	-.03	**.46**	.03	.14	-.17	**.52**	.02		.00	.18	-.26	**.47**	-.02	.98
63	.12	-.19	-.07	.01	**.58**	.00	-.14	-.01	**.54**	-.03		.13	-.20	-.08	**.57**	.03	.96
68	-.10	.04	.00	-.05	**.56**	-.09	.01	-.04	**.56**	-.06		-.09	.02	.01	**.56**	-.03	.99
78	-.14	.18	.23	-.06	**.47**	-.14	.19	.22	**.54**	.07		-.13	.15	.25	**.48**	-.05	.98
82	.15	.08	.13	.12	**.23**	*.32*	.06	.04	**.30**	.04		.17	.08	.13	**.22**	.11	.90
87	-.09	.06	-.09	-.10	**.56**	-.03	.00	-.08	**.65**	-.02		-.09	.04	-.08	**.57**	-.08	.99
92	-.01	.29	.02	.03	**.20**	.02	*.32*	-.07	**.40**	.08		-.01	.29	.04	**.21**	.06	.93
98	-.14	.28	.14	.10	**.24**	-.10	.21	.23	**.25**	.06		-.13	.27	.16	**.25**	.10	.97
%	7.42	5.54	5.17	4.58	4.35	6.74	5.58	4.84	4.69	4.51	CC	.97	.96	.96	.94	.93	.96

Notes. Loadings on the expected factor are in boldface and secondary loadings > .30 are in italics. CC: Congruence Coefficients.

Three independent principal component analyses with varimax rotation have been carried out of the items of each dimension made up of two subscales. The principal component analysis conducted on ImpSS's items allowed to extract two factors using Cattell's criterion. These factors explained 31.88% of the total variance. The first three eigenvalues were 4.12, 1.93, and 1.39. After a varimax rotation the two factors explained respectively 21.68% and 10.19% of the variance. A one-to-one association was observed between the two factors and the two ImpSS facet-scales. Factor 1 correlated with SS (r = .96), and Factor 2 correlated with Imp (r = .92). The inter-correlation between SS and Imp was .43. Most items were included in the originally assigned factor but some items had a secondary loading higher than .30: items 14 and 84 (Imp) loaded also on SS, and item 89 (SS) loaded also on Imp.

TABLE 3. Correlations between the five main dimensions and their subscales and the five factors after varimax rotation.

	Factors				
ZKPQ	F1	F2	F3	F4	F5
ImpSS	.03	**.94**	-.08	.18	.02
SS	-.05	**.90**	.12	.12	.09
Imp	.16	**.65**	-.37	.22	-.10
N-Anx	**.97**	-.07	-.03	.13	-.01
AggHost	.08	.03	.01	**.95**	.03
Act	-.06	.19	**.92**	.05	-.02
GA	.12	.16	**.83**	.13	.05
WE	-.26	.15	**.71**	-.07	-.11
Sy	-.07	.24	.05	.05	**.93**
PF	-.22	.39	.20	.10	**.67**
II	.11	.00	-.20	.00	**.87**

Note. The correlations above .60 in absolute magnitude are in bold.

The principal component analysis conducted on Act's items allowed to extract two factors using Cattell's criterion. These factors explained 31.66% of the total variance. The first three eigenvalues were 3.78, 1.60, and 1.19. After a varimax rotation the two first factors explained respectively 22.25% and 9.41% of the variance. A one-to-one association was observed between the two factors and the two Act facet-scales. Factor 1 correlated with GA (r = .93), and Factor 2 correlated with WE (r = .95). The inter-correlation between GA and WE was .41. Most items were included in the originally assigned factor but some items had a secondary loading higher than .30: item 13 (GA) loaded also on WE, and item 59 (WE) loaded also on GA.

The principal component analysis conducted on Sy's items allowed to extract two factors using Cattell's criterion. These factors explained 33.18% of the total variance. The first three eigenvalues were 3.68, 1.96, and 1.36. After a varimax rotation the two first factors explained respectively 21.65% and 11.52% of the variance. A one-to-one association was observed between the two factors and the two Sy facet-scales. Factor

1 correlated with PF (r = .94), and Factor 2 correlated with II (r = .96). The inter-correlation between PF and II was .36. Only one item had a secondary loading higher than .30: item 37 (PF) loaded also on II.

Procrustes rotation and congruence coefficients

To assess cross-language replicability, the loading matrices obtained in our French-speaking sample were subjected to an orthogonal procrustes rotation (McCrae, Zonderman, Costa, Bond, and Paunonen, 1996; Schönemann, 1966) using the American loading matrices as the target (Zuckerman and Kuhlman, 2004). For the global loading matrix the total congruence coefficient was of .96. The congruence coefficients were respectively of .96, .97, .93, .96, and .94 for ImpSS, N-Anx, Agg-Host, Act, and Sy. At the item-level, congruence coefficients ranged from .71 to 1. Only item 89 (ImpSS) had a coefficient lower than .80. Eighty-three items were associated to a coefficient higher than .90 (see Table 2). To assess cross-language replicability at the facet-level, three independent orthogonal procrustes rotations have been carried out for the matrices obtained for ImpSS, Act, and Sy. For the ImpSS-facets, the total congruence coefficient was of .98. The congruence coefficients were respectively of .98 and .97 for SS and Imp. At the item-level, congruence coefficients ranged from .91 to 1. For the Act-facets, the total congruence coefficient was of .98. The congruence coefficients were respectively of .98 and .97 for GA and WE. At the item-level item, the congruence coefficients ranged from .88 to 1. For the Sy-facets, the total congruence coefficient was of .99. The congruence coefficients were respectively of .98 and .99 for PF and II. At the level-item, the congruence coefficients ranged from .94 to 1.

Confirmatory factor analysis

Confirmatory factor analyses (CFAs) were carried out in order to assess the construct validity of the French version of the ZKPQ. To achieve model identification, regression coefficients of the error terms over the endogenous variables were fixed to 1. The CFA permits evaluating the adequacy of a proposed factor structure. The χ^2/df is a measure of the absolute fit of the model with the data, indicating how closely the model fits compared to a perfect fit. An acceptable χ^2/df is usually set at 3. The model is considered to have an acceptable fit if the GFI, TLI, and CFI values are of about .90 or above. The RMSEA is a measure of discrepancy per degree of freedom, a value of about .05 or less would indicate a close fit and a value of about .08 or less would indicate a reasonable fit of the model. According to these criteria, the original structure has acceptable fit (see Table 4). This model was improved by adding the second loading higher than .30 and by correlating error terms on bases of the modification indices.

TABLE 4. Comparison of several ZKPQ fit indices for the estimated models.

ZKPQ	χ^2	*df*	χ^2/df	*GFI*	*TLI*	*CFI*	*RMSEA*
89-item[(a)]	11008.59	3817	2.88	.73	.56	.57	.05
89-SL[(b)]	10374.52	3807	2.72	.74	.59	.60	.04
89-SL_r[(c)]	7944.44	3789	2.10	.80	.74	.75	.04

Notes. All chi-square values were significant, $p < .001$. GFI: Goodness of Fit Index; TLI: Tucker Lewis Index; CFI: Comparative Fit Index; RMSEA: Root Mean Square of Approximation. (a) Original items for each factor; (b) Adding secondary loadings higher than .30; (c) Error terms were correlated when the modification indices were > 50.

The construct validity at the facet-level was assessed by conducting three independent CFAs. For ImpSS the following results were observed: $\chi^2/df = 5.82$, GFI = .90, TLI = .70, CFI = .73, and RMSEA = .08. Adding secondary loadings higher than .30, slightly improved the results: $\chi^2/df = 4.45$, GFI = .92, TLI = .78, CFI = .81, and RMSEA = .06. Finally, the error terms were correlated when the modification indices were higher than 50: $\chi^2/df = 2.53$, GFI =.96, TLI = .90, CFI = .92, and RMSEA = .04. For Act the following results were observed: $\chi^2/df = 3.83$, GFI = .94, TLI = .84, CFI = .86, and RMSEA = .06. The results remained similar after adding secondary loadings higher than .30: $\chi^2/df = 3.29$, GFI = .95, TLI = .87, CFI = .89, and RMSEA = .05. All modification indices were lower than 50. For Sy the following results were observed: $\chi^2/df = 7.02$, GFI = .88, TLI = .67, CFI = .71, and RMSEA = .08. The results remained similar after adding secondary loadings higher than .30: $\chi^2/df = 6.81$, GFI = .89, TLI = .68, CFI = .73, and RMSEA = .08. The errors terms were correlated when the modification indices were higher than 50: $\chi^2/df = 3.95$, GFI = .93, TLI = .84, CFI = .86, and RMSEA = .06. These results indicate that the construct validity at the facet-level is acceptable but slightly lower compared to the general Five-Factor structure.

Discussion

The aim of this research was to investigate the psychometric properties of the French version of the ZKPQ and to analyze the cross-language replicability of the ZKPQ comparing this French version with original English one. The internal consistencies are similar to those found in the American sample and with other European translations (De Pascalis and Russo, 2003; Gomà-i-Freixanet *et al*., 2004; Herrero *et al*., 2001; Ostendorf and Angleitner, 1994; Zuckerman, 2002). The scale with the highest internal reliability was for women and men, N-Anx, and the scale with the lowest internal reliability was for women, Agg-Host, and for men, Act. Gomà-i-Freixanet and colleagues (2004) report that the internal reliability for Agg-Host is usually lower in translations of the ZKPQ. This was not the case in this French version and the reliabilities were above .70 for women and men. On the facet-scales, the alphas are generally slightly lower in the Swiss sample compared to the American sample (Zuckerman, 2002). For women, the reliability is lower for the WE facet-scale, and for men the reliability is

lower for the Imp and the WE facet-scales. For women, the reliability was higher in the Swiss sample for GA. However, all reliabilities were acceptable.

Sex differences are similar to those found in the original American sample (Zuckerman *et al*., 1993). Women score higher on N-Anx and lower on ImpSS, Act and Inf than men. However the mean score on Agg-Host is not significantly higher for men as in the American sample. The difference between women and men on ImpSS was mainly due to a difference on SS. No gender difference was observed on Imp. The gender difference on Act was mainly due to a difference on WE. Interestingly, no gender difference was observed on Sy as observed in the Catalan, German, and Japanese samples (Gomà-i-Freixanet *et al*., 2004; Ostendorf and Angleitner, 1994; Shiomi *et al*., 1996), but women scored lower on PF and higher on II compared to men. Thus some slight differences between countries are observed at the level of gender differences that might be attributed to the sample selection, the translation, or the cultural context. However, the gender differences in this Swiss sample follow the general trend found in other samples and with other versions of the ZKPQ.

The principal component analysis with a varimax rotation allowed extracting five factors, explaining 27.06% of the variance. These factors were closely associated to the theoretical five dimensions. Indeed, we observed a one-to-one association between the factors and the basic factors postulated by the AFFM (r = .92). The correlation between the five dimensions of the ZKPQ are very low (r = .22) confirming these basic factors are orthogonal as postulated by the AFFM. The principal component analyses conducted at the facet-level confirmed the structural validity of the hierarchical model proposed by Zuckerman (2002). For each basic factor made up of two facets, a one-to-one association between the two factors and the two facets was observed (r = .92). This study is the first assessing the structural validity at the facet-level and confirms the reliability and validity of this lower-level scales.

The cross-language replicability is an important criterion for assessing the validity of model claiming that personality traits are biologically rooted (Aluja *et al*., 2006; Aluja, García, Rossier, and García, 2005; Duarte and Rossier, in press; Rossier, 2005). The congruence coefficients after a targeted factor analysis show that the cross-cultural replicability of the ZKPQ is very high. Indeed, the total congruence coefficient was of .96 and the congruence coefficients at the factor level were all equal or above .93. The results are very similar to those observed using the NEO-PI-R aimed in assessing the FFM (Rolland, 2002; Rossier, 2005; Rossier'*et al*., 2005). The analyses at the facet-level have shown a very high cross-language replicability with total congruence coefficients of .98 or higher. This study confirms the high cross-language replicability of the ZKPQ found by Gomà-i-Freixanet and colleagues (2004). The congruence coefficients obtained in this study are slightly higher to those observed in the Catalan sample. However, Gomà-i-Freixanet and colleagues (2004) calculated congruence coefficients without conducting a targeted factor analyses. This study confirms the cross-language replicability of the five basic factors and the facet-scales of the AFFM (Zuckerman *et al*., 1993; Zuckerman, 2002).

Confirmatory factor analyses have been performed to test the adequacy of the structure of this model. Concerning the 89-item version, the results are very similar to

those found by Aluja and colleagues (2003). The fit of the model is high when considering the χ^2/df or the RMSEA measures. However, the values of the GFI, TLI, and CFI indicated a poor fit. This type of conflicting results is usually observed in personality models (Vassend and Skrondal, 1995, 1997). According to Sharma, Mukherjee, Kumar, and Dillon (2005), the use of fit indices as the GFI is not recommended because the sample size and the number of variables affect them. They suggest paying more attention to the RMSEA measure. According to this measure the 89-item model has a reasonable fit. Another reason that could explain these conflicting results is the presence of secondary loadings and of correlation between the error terms. For this reason, we took into account these two aspects in two alternative models (89-SL and 89-SL_r). The values on all fit indices were slightly improved by adding the secondary loadings higher than .30 and by correlating the error terms when modifications indices were higher than 50. At the facet-level, very similar results were observed.

To conclude, the French version of the ZKPQ is a reliable and valid tool for assessing personality traits. The internal consistencies are satisfactory and similar to those found for other versions of the ZKPQ at the factor and at the facet-level. The differences between genders are congruent to those observed in the original American sample and with other translations. The principal component analysis replicated the five-factor structure postulated by AFFM and confirmed the orthogonality of these factors. Morover, the cross-language replicability of the AFFM is very high at the factor and at the facet-level. This replicability is similar to the one observed with the FFM. Confirmatory factor analyses support the adequacy of the AFFM and of the lower-level structure. Thus, the AFFM seems to be relevant alternative to the FFM, and the French version of the ZKPQ seems to be a valid and useful tool to assess personality traits according to this AFFM.

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