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A Comparative Study of General Intelligence in Spanish and Moroccan Samples

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The aim of this study is to fill a gap in intelligence research by presenting data for the average IQ in Morocco and for a comparable sample in Spain. Adult samples were administered the *Raven Standard Progressive Matrices (SPM)* (Raven, Court, & Raven, 2001) and scored for the total test and for the three sub-factors of gestalt continuation, verbal-analytical reasoning and visuospatial ability identified by Lynn, Allik, and Irwing (2004). The total test and the three factors have shown satisfactory reliability. Our results for the Moroccan sample show significant relationship between general intelligence factor, gestalt continuation and visuospatial ability with education level and income. Conversely, these variables have been shown to be independent for the Spanish sample. This sample obtained significantly higher scores for the four factors assessed than the Moroccan one. These differences have been found also comparing samples with the same education levels. Finally, the errors percentage for Moroccans has been higher than for Spaniards in all the items, suggesting that the level of difficulty was higher for the Moroccan sample.
Keywords: general intelligence, SPM factors, Spain, Morocco.

El objetivo de este trabajo es llenar un hueco en el campo de la investigación en inteligencia con la presentación de datos sobre el Cociente de Inteligencia (CI) promedio en Marruecos comparándolo con una muestra similar de adultos españoles. Para ello, se ha administrado a ambas muestras la *Escala General de las Matrices Progresivas de Raven* (SPM) (Raven, Court, & Raven, 2001), obteniéndose la puntuación total de la escala así como de los tres sub-factores aislados por Lynn, Allik, and Irwing (2004). La fiabilidad de la escala total y de los tres factores ha sido satisfactoria. Nuestros resultados muestran relaciones significativas entre el factor general de inteligencia, el factor de continuación de una figura (gestalt) y el factor visoespacial con el nivel educativo y los ingresos económicos en la muestra marroquí. Por el contrario, estas variables fueron independientes en el caso de la muestra española. Por otra parte, esta muestra ha obtenido puntuaciones significativas más altas en los cuatro factores de inteligencia evaluados que la muestra marroquí. Estas diferencias se han mantenido incluso cuando se han comparando muestras con los mismos niveles educativos. Finalmente, el porcentaje de errores de la muestra marroquí ha sido más alto que en la muestra española en todos los ítems, lo que indica que el nivel de dificultad ha sido más alto para la muestra marroquí.
Palabras clave: inteligencia general, factores de SPM, España, Marruecos.

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National IQs for all countries in the world presented by Lynn and Vanhanen (2002, 2006) have generated a research program consisting of the refinement of these national IQs and the examination of their economic, social, demographic, and epidemiological correlates. The main objective of the study reported here is to contribute to this research program by comparing representative samples from Morocco and Spain. There are some previously published data on the IQs of Moroccan immigrants in the Netherlands, in which samples of Moroccans obtained lower scores in intelligence tests than native Dutch (Sijtsha & Resing, 1991; Te Nijenhuis & van der Flier, 1997; Te Nijenhuis, Evers, & Mur, 2000; Te Nijenhuis, Tolboom, Resing, & Bleichrodt, 2004a; Te Nijenhuis, de Jong, Evers, & van der Flier, 2004b; Te Nijenhuis, van Vianen, & van der Flier, 2007). However, immigrants are not necessarily representative of indigenous populations. We have carried out a literature and bibliographical search for studies on intelligence in Morocco and, apart from our own previous data (Sellami, Infanzón, Lanzón, Díaz, & Lynn, 2010), we have found only one study on intelligence on anaemic children (Aboussaleh et al., 2006). The present work is intended to fill this gap.

An important issue in this work was to choose a scale appropriate to assess general intelligence. Spain and Morocco, as close as they are geographically, are very different in matters of education, religion, economic development, and many other aspects. Accordingly, we tried to find a cultural reduced scale, with a minimum of verbal factors, with no time constraint and previously used in a broad range of different countries. The *Raven´s Standard Progressive Matrices* (SPM) was chosen as it complies with all of these conditions. However, it has to be taken into account that other aspects, such as nutrition, hygiene, welfare state, anxiety trait, stress, menstrual cycle, perceived difficulty or previous experience in answering tests (test wiseness), may influence the SPM score. In this context, Raven et al. (2001) in the SPM manual warns about nutrition, welfare state and hygiene in the increasing in general intelligence in the last generations in Western countries, "the Flynn effect" (Flynn, 1984, 1987). Benton and Roberts (1988) and Eysenck and Eysenck (1991) raise the argument that factors such as diet conditions or weight at birth affect reasoning. The study of Kumari and Corr (1998) showed the influence of the anxiety trait, stress and even the menstrual cycle in the SPM score. Sijtsma and Resing (1991) in Holland with samples of immigrants from Turkey, Morocco and Surinam, and Taschinski (1985) in Germany with Turkish immigrants found lower intelligence levels than Dutch and Germans respectively, and this lower level was attributed to the higher perceived difficulty in the scale in the case of the immigrants. However, Rushton and Skuy (2000), Rushton, Skuy, and Fridjhon (2002, 2003) and Skuy et al. (2002) found identical item difficulty structures, using Progressive Matrices on samples of thousand of high school students and hundreds of university students, for Africans, Whites and East Indians in South Africa. Basically, items found difficult by one group were difficult for the others and items found easy by one group were easy for the others. Finally, Jensen and Rushton (2005) and Te Nijenhuis, Voskujil, and Scrijve (2001) argue and refute that groups who answer a intelligence test the first time are less test-wise. According to these authors, although in some cases when these groups are trained (such as in the Skuy et al., 2002 study) an improvement in intelligence level is found, it is unclear if the intervention procedures only increase performance through mastery of subject-specific knowledge or whether they increase g-like problem solving ability that generalizes to other tests as well. When the aim of a study is to compare very different samples, the same instructions to answer a test could be enough for one of the samples and not for the other, and repeating the instructions or preliminary practice with some of the items may be necessary to be fair in the comparison. That was shown to be the case in the study by Tanzer, Gittler, and Ellis (1995) who when comparing American and Austrian samples in the 3-Dimensional Cube Comparison Test (3-DCT), a spatial ability test, had to give some warm-up items to ensure cross-cultural equivalence.

Although in the study we present in this paper we could not control all the above discussed factors affecting the SPM score, we have, as a second objective, analysed the data on the difficulty level for both samples by comparing the errors committed by the samples in answering the SPM. The results of this analysis may help in devising new approaches to the administering of the test in future samples in cross-cultural comparisons.

Method

The *Raven Standard Progressive Matrices (SPM)* (Raven et al., 2001) was administered to 460 subjects, 258 from Spain, mainly from the city of Valencia, and 202 from Morocco, from the cities of Casablanca, Marrakech, Meknes and Tangiers. The Spanish sample had a mean age of 25.19 years (range from 18 to 65), and the Moroccan sample had a mean age of 26.77 years (range from 18 to 50). We found literacy difficulties in people over 50 years old in the Moroccan sample. The scale was administered without time limits for both samples. To obtain the samples we contacted the directors of university halls of residence. With the agreement of the directors we then contacted the residents, consisting of university students studying a wide range of subjects, and the staff of the hall of residences; administrative staff, cleaners, waiters and cooks. We tried to get a similar sample in both countries, using halls of residence in different university cities in Morocco and Spain as starting point. This sampling method provided samples which included not only university students, but also subject

Table 1
Sample description

		Moroccan = 202		Spanish = 258	
		N	(%)	*N*	(%)
Gender	Men	92	(45.5)	101	(39.1)
	Women	110	(54.5)	157	(60.9)
Job	Yes	121	(60.0)	135	(52.7)
	No	81	(40.0)	123	(47.3)
Education	Primary	14	(7.0)	31	(12.3)
	Secondary	73	(36.0)	69	(26.7)
	University	115	(57.0)	158	(61.0)
Marital Status	Married	39	(19.3)	40	(15.6)
	Divorced	4	(2.0)	2	(0.8)
	Single	159	(78.7)	216	(83.7)
Income	< 300 €	34	(16.8)	7	(2.7)
	300-900 €	75	(37.1)	70	(27.1)
	901-1500€	64	(31.7)	105	(40.7)
	> 1500 €	29	(14.4)	76	(29.5)
Age	Range	18-50		18-65	
	Mean	26.77		25.19	
	Median	24.00		22.00	
	SD	7.76		8.84	

with lower educational levels, avoiding in this way the "convenient" samples exclusively made up of university students. When these samples had performed the test, we obtained further subjects through the social network of these initial subjects. Answering the test was voluntary and anonymous, and no reward was given for answering it. The same oral instructions were given to both samples and, in both cases, if the subject failed the first item, the instructions were repeated again and an explanation of the reasoning behind the correct answer to this item was given to the subject.

Table 1 shows the more important demographic characteristics. Some of them are similar in both samples, such as gender composition, percentage of employed people, education and marital status; with more women than men, more people working, more with university education and more singles. About the 60% were students, 115 (57%) in Morocco and 158 (61%) in Spain. The remaining subjects were people working in halls of residence and their relations and acquaintances. There were differences in incomes between the two samples: more Moroccan were in the two lower levels (from <300 to 900€) whereas more Spanish were in the higher levels (from 900 to > 1500€). This difference was expected due to the economic differences between both countries.

The *Raven Standard Progressive Matrices (SPM)* (Raven et al., 2001, standardizated in Spain by Seisdedos, 1995) consists of 60 items split in 5 series (A, B, C, D, E), with each series containing 12 items of increasing difficulty. The analyses have been performed both with the "Raven" factor including the total score from the Raven SPM 60 items, and with the three factors from Lynn et al. (2004): "gestalt continuation", factor obtained by perception of the pattern as a gestalt and identifying the appropriate piece for its completion without the use of reasoning; "verbal analytic reasoning", factor obtained from items which require verbal reasoning for their solution in the form of arithmetical addition and subtraction problems; and "visuospatial ability", factor obtained from items whose solution can be found perceptually. The data have been analysed using SPSS.18.

Results

The test was scored for the total score, Raven factor, and scores on the three sub-factors of gestalt continuation, verbal-analytical reasoning and visuospatial ability identified by Lynn et al. (2004). The Cronbach α reliability of the scores are shown in Table 2 and are satisfactory for the four factors. Only gestalt continuation in the Spanish sample has a more modest reliability with only .69.

Table 3 shows the Pearson correlations between the four intelligence factors and educational and income variables.

Table 2
Reliability Cronbach's alpha

	Items	Moroccan = 202 α	Spanish = 258 α
Raven	60	.96	.90
Gestalt continuation	18	.93	.69
Verbal-analytic reasoning	10	.82	.76
Ability visuospatial	22	.94	.85

Table 3
Pearson Correlation between Intelligence, Education and Income for Moroccan and Spanish samples

	Moroccan (N= 202)		Spanish (N=258)	
	Education	Income	Education	Income
Raven	.22**	.20**	.03	–.09
Gestalt continuation	.23***	.21**	–.03	–.07
Verbal-analitic reasoning	.07	.05	.07	–.09
Ability visuospatial	.22**	.21**	-.01	–.07

** = $p < .01$; *** = $p < .001$

Table 4
Cohen's d between Moroccan and Spanish samples in Raven Standard Progressive Matrices and Lynn Three Factors: Gestalt Continuation, Analytic Reasoning and Visuospatial Ability

	Spanish		Moroccan		
	Mean	*SD*	Mean	*SD*	*d*
Raven	51.83	7.02	43,73	13,8	.72
Gestalt continuation	17,55	1,10	15,97	3,39	.60
Verbal-analytic reasoning	6,11	2,57	4,28	2,92	.66
Ability visuospatial	18,96	3,16	16,95	5,17	.46

For the Raven total scale factor we have obtained "d" using the standard deviation of 6.7 from the national standardization data of SPM en Spain (Raven et al., 2001)

There is a clear independence between all of them for the Spanish sample, but in the Moroccan sample we found a positive and significant relation between both education and income variables with general intelligence, gestalt continuation and visuoespatial ability. It seems that a more complete education and higher income is associated with higher general intelligence gestalt continuation and visuospatial ability. Verbal-analytic reasoning has no relation with education and income.

Means, standard deviations and standardized differences (Cohen´s d) between Spanish and Moroccan samples are shown in Table 4. All differences are medium with higher general intelligence, gestalt continuation, verbal-analytic reasoning and ability visuospatial scores in the Spanish than in the Moroccan samples.

In an attempt to reduce the effect of different levels of education, the comparisons have been done separately for the three education level between both samples for the SPM total score. The results have shown higher scores in the total SPM score for the Spanish sample in every education level: primary studies ($F(1, 43) = 13.05$; $p \leq .001$), secondary ($F(1, 140) = 30.15$; $p \leq .000$) and university ($F(1, 271) = 25.30$; $p \leq .001$).

Percentage of errors in the 60 items of SPM are shown in Table 5 and Figure 1. The same information for the 5 Sets is shown in Figure 2. All the percentages have been higher for the Moroccans than for the Spaniards, and significant for 59 of the SPM 60 items. To examine whether the difference between the Moroccan and Spanish samples is in g (Spearman´s hypothesis), we have run the correlation between the differences in the items and their g loadings, given in Table 5. The 52 g loadings are taken from Lynn et al. (2004). The correlation is -.20 and is not statistically significant ($p = .13$). This result clearly indicates that the difference between the Moroccan and Spanish samples is not in g.

Table 5
Percentage of errors answering the SPM and g loading in both samples

Set A				Set B				Set C				Set D				Set E			
Item	g	Mor %	Spa %	Item	g	Mor %	Spa %	Item	g	Mor %	Spa %	Item	g	Mor %	Spa %	Item	g	Mor %	Spa %
1		12.4	0.4	13		6.9	1.6	25	.72	16.8	2.7	37	.61	12.9	2.7	49	.55	18.3	7
2		6.9	0.8	14	.67	18.3	1.2	26	.69	12.9	0.8	38	.68	15.3	2.7	50	.63	31.2	10.5
3		7.9	1.2	15	.78	8.9	1.6	27	.62	11.9	2.7	39	.67	16.8	4.7	51	.62	33.2	7.8
4		9.4	0.0	16	.67	15,3	1.9	28	.53	16.3	10.1	40	.66	22.4	12.4	52	.57	30.7	14
5		11.4	0.4	17	.56	14.9	3.5	29	.65	14.9	8.1	41	.71	19.3	10.9	53	.65	27.7	14.7
6		9.9	0.4	18	.44	10.4	4.7	30	.47	23.3	7.4	42	.68	27.2	10.5	54	.56	38.6	20.9
7	.68	14.4	1.6	19	.43	21.3	7.0	31	.65	18.3	8.9	43	.52	25.2	14.0	55	.37	42.6	25.2
8	.43	16.3	3.1	20	.51	28.2	11.6	32	.51	34.2	15.1	44	.56	25.2	13.6	56	.43	54.0	31
9	.73	11.4	0.8	21	.58	26.7	10.5	33	.40	23.3	17.1	45	.54	33.2	13.6	57	.44	54.0	36
10	.38	12.9	3.5	22	.71	22.8	6.2	34	.48	35.6	22.5	46	.68	34.7	15.1	58	.43	54.0	37.2
11	.57	21.3	12.4	23	.56	28.2	11.6	35	.51	41.1	21.3	47	.26	58.9	41.5	59	.40	77.7	58.1
12		39.6	16.3	24	.51	34.2	23.6	36	.47	65.8	56.2	48	.33	72.8	49.6	60	.37	76.7	64.3

Mor=Moroccan; Spa=Spanish; g = g loadings from Lynn et al. (2004)

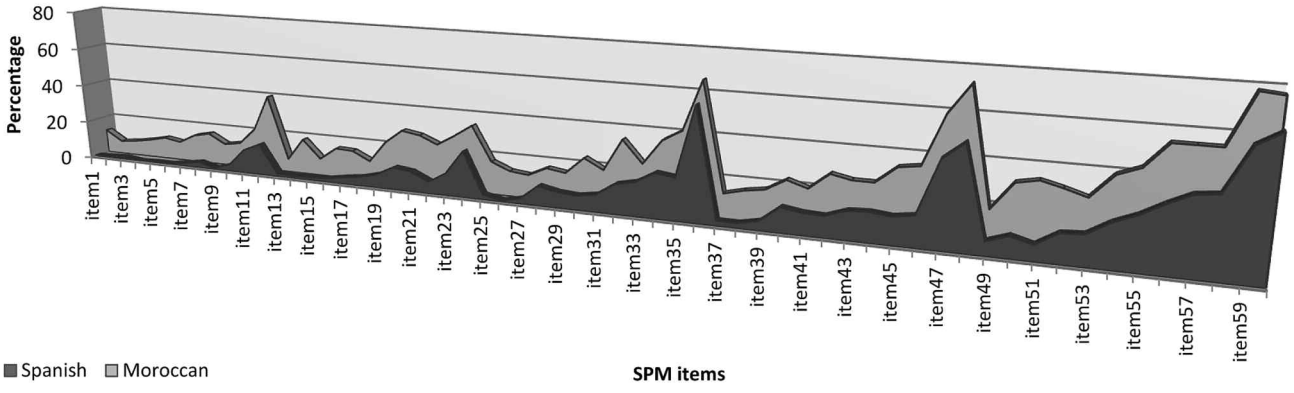

Figure 1. SPM errors percentage graph

Discussion

The result that the Spanish sample obtained significantly higher scores on the four factors than the Moroccan sample confirms the conclusion presented by Lynn and Vanhanen (2006) that the average IQs in North Africa are lower than those in Europe. The Progressive Matrices is an excellent measure of Spearman's g (Jensen, 1998). We can estimate the Spanish and Moroccan IQs in terms of the metric used by Lynn and Vanhanen (2006) in which national IQs are calculated as follows. The mean score of the Spanish sample (51.83) is at the 42nd percentile of the 1992 British standardization sample given in Raven, Court, and Raven (1996, p. 62) and is equivalent to an IQ of 97. No adjustment is made for a Flynn effect in Britain because there has been no increase in SPM scores in Britain among those aged 13+ years from 1979 (Lynn, 2009). This is virtually identical to the Spanish IQ = 98 for Spain given by Lynn & Vanhanen (2006, p.308) based on the median of three studies (Albalde & Muñoz, 1993; Colom & García-López, 2002; Raven, 1996). It can therefore be inferred that the Spanish sample is representative of the Spanish population. The Moroccan sample is matched to the Spanish sample and it can therefore be inferred that the Moroccan sample is representative of the Moroccan population. The mean score of the Moroccan sample (43.73) is at the 10th percentile of the 1992 British standardization sample given in Raven et al. (1996, p. 62) and is equivalent to an IQ of 81. This is slightly lower than the median IQ of 84 calculated from five samples of Moroccan immigrants in the Netherlands by Lynn and Vanhanen (2006). The likely explanations for the slightly lower IQ of the present sample, when compared to that of Moroccan immigrants in the Netherlands, are that immigrants have slightly higher IQs than the indigenous population in their country of origin, and that they may

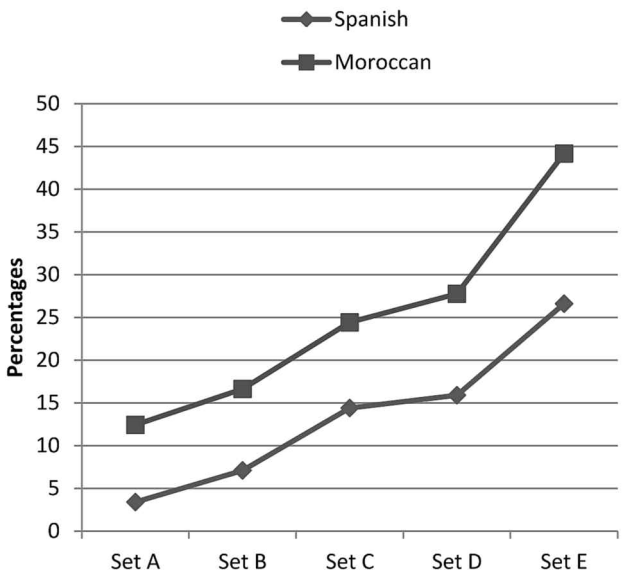

Figure 2. SPM mean/set errors percentages graph

have had an environmental advantage arising from an economically developed society.

The comparison between Spaniards and Moroccans in general intelligence in each education level has shown that, even when the level of studies is matched, the Spanish sample scores higher in the SPM than the Moroccan one. This result seems to rule out the possible role of education to explain the differences found in our study.

About the items difficulty level, the errors made in the SPM by both samples are shown in Table 5. For the two samples, items from the Set E were the most difficult, followed by Sets C and D, while Sets A and B were the easiest. From the Figure 2, it is clear that the difficulty from Set A to Set E increase in parallel for both samples, with a increasing in the slope in the set E, which almost doubles the difficulty level of the previous Set D. Fig. 1 shows the percentage of errors in a graph that presents more clearly the differences between the samples, and the higher peaks in the distribution show the ceiling effect for both samples. Although from the graph it is clear that the subjects in the Spanish sample have made less errors than the Moroccan ones, we have compared the percentage for every item in the SPM. All of them have shown significant differences between the samples except for a tendency ($\chi 2 = 2.76$; $p < .09$) in item 9 (set C). Forty six items have got χ^2 significant to $p \leq .001$; ten items to $p \leq .01$; and three to $p \leq .05$. From this data we consider that the difficulty level for the Moroccan sample has been higher than for the Spanish one. Relatively few of the 60 items have P-values (proportion passing) within the optimal range of .30–.70 that provides maximum discriminatory power; there are only 8 such items for the Spanish sample and 20 for the Moroccan one. Using a proportion of less than 30% of respondents failing as the criterion for judging an item as ‘‘too easy,’’ 52 of the 60 items (86,7%) proved too easy for the Spanish, and 40 (66,7%) for the Moroccan. In this respect, our results are closer to those presented by Sijtsma and Resing (1991) in that the Moroccans are situated lower in SPM score than, in our case, the Spaniards and that difficulty may have a main role. In our study, it is not possible to argue that the samples are “convenient”, because we have followed the same procedure to get them, from the starting point of halls of residents, in different university cities in Morocco and in a Spanish city, Valencia.

A final issue remains to answer, would it be advisable to do some warm-up items to be fair in the comparison, and to be sure that subjects have properly understood the instructions?. Looking into the error´s percentages in the first items, only the percentage in the first item in the Moroccan sample is too high, especially when compared with the percentages in the next two items, 2 and 3. A percentage of 12.4 failing the first and easiest item, followed by 6.9 in the second, and 7.9 in the third, made us think that the procedure we had used, namely, to explain again the instructions and to show the subjects that had failed the first item the rationale for the correct answer for this item, was basically correct. Notwithstanding this, we consider that adding at least one item as warn-up, as suggested by Tanzer et al. (1995), would constitute a worthwhile improvement in the procedure.

This paper presents what, to our knowledge, is the first comparison of native, non immigrant Moroccans sample with a similar Spanish sample in general intelligence using the Raven Standard Progressive Matrices. Samples have been carefully chosen and matched for educational level and, additionally, we have made a trial to explain a possible factor that could affect our results, the difficulty level. Consequently, even accepting the limitations of our study, we consider that our results are valid and open the way for further work in this field.

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