



ORIGINAL RESEARCH PAPERS

# The detection of individual psychological differences of native Spanish and immigrants from Morocco, based on testing of proprioceptive control in fine motor performance



Liudmila Liutsko<sup>a,b,c,d,e,\*</sup>, Yulia Malova<sup>d</sup>, José Gutiérrez Maldonado<sup>e</sup>,  
Josep Maria Tous Ral<sup>e</sup>

<sup>a</sup> ISGlobal, Barcelona, Spain

<sup>b</sup> CIBERESP, Madrid, Spain

<sup>c</sup> UPF, Barcelona, Spain

<sup>d</sup> Lomonosov Moscow State University, Moscow, Russia

<sup>e</sup> University of Barcelona, Barcelona, Spain

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analysis

## Abstract

**Background:** Russian physiologists and psychologists posed the questions of the levels of psychic regulation of the temperament, character and personality (Anan'ev, 1980; Nebylitsin, 1966; Pavlov, 1951; Teplov, 1963). The aim of our study was to observe the differences due to both – cultural nature and individual changes in personality – relevant to adjustment mechanisms in Arabic migrants in Spain.

**Method:** Proprioceptive Diagnostics of Temperament and Character (DP-TC, Tous Ral et al., 2012) was used to obtain observations in fine motor performance in two groups: immigrants from Morocco to Spain and Spaniards. The DP-TC of individual and personality differences is based on fine motor precision tasks and allows comparing performances of participants from different cultures with no bias of linguistic interpretation.

**Results:** The significant differences in fine motor performance (proprioceptive condition) were found in average group's results. The consequent interpretation of their personality and individual behavioural differences was realised as per the DP-TC test dimensions. The results are discussed in terms of the interplay between possible cultural and individual differences concerning changes, related to the adjustment in migration processes.

\* Corresponding author.

E-mail address: [liudmila.liutsko@yahoo.es](mailto:liudmila.liutsko@yahoo.es) (L. Liutsko).

<sup>1</sup> Affiliations a–c are current affiliations of Dr. Liudmila Liutsko, the data were collected during the PhD work (affiliation e) and post-doc short stay in Moscow (affiliation d).

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**PALABRAS CLAVE**

Precisión motora fina;  
 Diagnóstico  
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 temperamento y del  
 carácter;  
 Adaptación en  
 inmigrantes;  
 Aculturación;  
 Análisis discriminante

*Conclusion:* The assertiveness'-related temperament-features in migrants were found low together with cultural differences in variability of behaviour and attention style.

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### La detección de las diferencias psicológicas individuales de los españoles nativos y los inmigrantes de Marruecos, basándose las pruebas de control propioceptivo en el rendimiento motor fino

**Resumen**

*Antecedentes:* Los fisiólogos y psicólogos rusos plantearon las cuestiones de los niveles de regulación psíquica del temperamento, el carácter y la personalidad (Pavlov, 1951; Anan'ev, 1980; Teplov, 1966; Nebylitsin, 1966). El objetivo de nuestro estudio fue observar las diferencias debidas tanto a la naturaleza cultural como a los cambios individuales en la personalidad, relevantes en los mecanismos de ajuste en los migrantes.

*Método:* Se utilizó el Diagnóstico Propioceptivo del Temperamento y del Carácter (DP-TC, Tous et al., 2012) para obtener observaciones en el rendimiento motor fino en 2 grupos: inmigrantes de Marruecos a España y españoles. El DP-TC se basa en tareas de precisión motora fina y permite comparar las actuaciones de participantes de diferentes culturas sin sesgo de interpretación lingüística.

*Resultados:* Se encontraron las diferencias significativas en el rendimiento (condición propioceptiva) según los resultados promedios de los grupos. Se realizó la correspondiente interpretación de las diferencias en personalidad. Los resultados se discuten en términos de la interacción entre las posibles diferencias culturales e individuales relacionadas con el ajuste en los procesos migratorios.

*Conclusión:* Los rasgos de temperamento relacionados con la asertividad en los migrantes se encontraron bajos junto con diferencias culturales en variabilidad de comportamiento y estilo de atención.

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**Introduction**

As soon as psychological diagnostics in the main part are very dependent to language and other cultural differences; the application of the psychological methods, based on the testing of the proprioceptive control, to the needs of psychological help in immigrants is very reasonable (Chui, Ng, Fong, Lin, & Ng, 2007).

Very few studies were done in relation of cultural and individual differences in the proprioceptive fine motor precision due to general ignorance of motor control field applied to psychology that currently plays a role of the "Cinderella" as defined by Rosenbaum (2005). However, some studies report about relation of motor control and cognition. Thus, East Asian American children were found to have more advanced final skills compared to the matched in socio-economic status European American children; moreover, fine motor performance was found to be a significant predictor of mathematics achievements (Luo, Jose, Huntsinger, & Pigott, 2007).

In the previous study, the change of task from single (just fine motor precision) to a dual one (combined with a cognitive charge – counting back numbers), the changes were found in proprioceptive movement precision had occurred,

such as increasing a line length that corresponded to the shift to the excitability pole in the Proprioceptive Diagnostic of Temperament and Character (DP-TC in Spanish original abbreviation) in a balance of Excitability-Inhibition dimension (Liutsko, Tous, & Segura, 2014). As indicate other studies, the proprioceptive fine motor precision depends on age, being worse while maturing (before 18 y.o.) and slowly starting to decline after 50 y.o. due to ageing processes (Liutsko, Muiños, & Tous, 2014). Better performance in the delayed visual memory tasks was also relayed to fine motor precision of some specific movement types (Liutsko, Tous, & Muiños, 2012). Moreover, individual differences pattern in fine motor precision were found to be important as health indicators since some movement types or congruence in hands performances were significantly different from the control groups in patients with Parkinson (Gironell, Liutsko, Muiños, & Tous, 2012); multiple sclerosis (Liutsko & Tous, 2013a, 2013b); psychiatric diseases (Efremov, Sluchaevskii, Popov, & Dunaevskaia, 1982); adaptation to stress in onco-patients (Liutsko, Malova, Poddubnij, Rozhkova, & Maldonado, 2016), and children with ADHD (Iglesias, Liutsko, & Tous, 2014).

Serpell (1979), in his study of pattern reproduction tasks in Zambian and British schoolchildren, concluded that cross-

cultural differences in performance of pattern reproduction tasks reflect different sets of highly specific perceptual skills rather than differences on broader cognitive variables. Going in line with the conclusion of Serpell, we would like to check the proprioceptive perception feedback based on the precision of fine movements (Tous-Ral, Muiños, Liutsko, & Forero, 2012) in endogenous and immigrant population. In order to achieve this, the most appropriate method, as an objective tool and free of personality biases due to linguistic adaptation problems in translation or perception (Ramírez-Esparza, Gosling, Benet-Martínez, Potter, & Pennebaker, 2006) or faking due to social desirability that can also change final results of personality verbal tests (Liutsko, 2014b; Tous, Muños, & Liutsko, 2014). In addition this test was produced within Mira y Lopez tradition, as the Myokinetic Psychodiagnostics (Mira, 1940, 1958), with use of new technologies (Tous Ral, Muiños, Tous, & Tous Rovirosa, 2012), can be used on population without advanced or any specific linguistic knowledge, as the M.K.P.<sup>2</sup> was used in indigenous population in Far North East region previously (Berezin, Varic, & Gorelova, 1976).

The previous study showed that significant cross-cultural differences exist in the proprioceptive movements, and they can slightly vary in women compared to men subgroups (Liutsko & Tous, 2014). For this study we choose the immigrants from Morocco since they are more sensitive to stress caused by immigration by higher difference in language, culture and religion. Acculturation stress due to contact with a different country and combining of both cultures (home and host) and higher suicidal and psychopathological rates in immigrants were reported in by other researchers (Ratkowska & Leo, 2013). In this process the personality interplays the role of moderating effect on the relationship between host national contact and cross-cultural adjustment (Caligiuri, 2000).

The aim of this study was to see the both cultural and individual differences in personality that underlie adaptation<sup>3</sup> mechanisms in Arabic population in Spain. The results could put more light on the effect of individual together with cultural differences that could have both negative and positive effects on adaptation.

## Methods

### Participants

Volunteers from Spanish population ( $N = 31$ , age:  $33 \pm 7$  years old) and immigrants from Morocco to Spain matched in age and education level, as per declared years of total education, ( $N = 24$ , age:  $28 \pm 9$  years old) participated in the study of fine motor precision to compare the results between performances of both groups in both hands. The ethical issues were approved prior the study.

<sup>2</sup> By some authors mentioned also as MKP.

<sup>3</sup> These adaptation mechanisms are measured, as per classical interpretation both M.K.P. of Mira y López (1940) and DP-TC of Tous methods (Tous et al., 2012; Tous & Liutsko, 2014), by incongruence of performances in both hands (see also the articles of Ezhov and Krivoshchekov (2004) and Blatt (1959).



Figure 1 DP-TC test performance (lineograms: frontal movement type, dominant hand).

### Instruments and data analysis

Proprioceptive Diagnosis of Temperament and Character (DP-TC in Spanish abbreviation) was used for observing fine motor behaviour in proprioceptive conditions of test (Figure 1). The computerised software (Tous, Viadé, & Muiños, 2007; Tous, 2008) allowed fixing and measuring size and spatial deviations of participant from the lineal models in condition with vision and without vision (proprioceptive-only). The observable variables were obtained from two types of stimuli: (1) lineograms (line models of 40 mm length) – directional (D, deviations occurred parallel to line models), formal biases ( $F^4$ , deviations occurred perpendicular to line models) and line length (LL) and 2) from parallels – line length variability. Both stimuli were represented for each hand (D – dominant and ND or non-dominant), and lineograms for three type of movement also: F – frontal, T – transversal and S – sagittal.

Similar to M.K.P. of Mira (1958), the patterns in proprioceptive movement biases correspond to different personality dimensions with two poles in each: (1) Mood (pessimism – optimism); (2) Decision-Making (submission – dominance); (3) Attention Style: intra-tension and extra-Tension (inward – outward); (4) Emotivism (cold/distant – warm/affiliated); (5) Irritability (behavioural inhibition – excitability); (6) Variability/Impulsivity (rigidness – variability in behaviour) (Tous, 2008; Tous Ral et al., 2012; Tous, Liutsko, Malova, & Gutierrez, 2014; Malova & Liutsko, 2013).

SPSS v.19 was used for performing descriptive data of spatial errors; ANOVA and discriminative analysis for both groups' performances, Cohen's  $d$  were calculated with use of formula in Excel.

### Theory/calculation

Mira and López (1940, p.128; also cited in Blatt, 1959) assumed in his M.K.P. method that "the dominant hand reveals the characteristic attitudes and reactions of the more practiced and controlled aspects of the subject [...]" that "are seen as transitory, phenotypic, and conscious" whereas the non-dominant hand is related more to "the

<sup>4</sup> This letter is used in the first position in the variable abbreviation, for example: FF – formal deviation in frontal movement; DT – directional bias in transversal movement.

predominant, constitutional, genotypic, instinctive expressions”.

Ezhov and Krivoshchekov (2004) used the frontal movement of the lineograms of the Mira y López myokinetic psychodiagnosis (Mira, 1958), on which DP-TC is based with use of new technologies (Tous et al., 2012), in order to see the adaptation of sportsmen to a new time zone (seven hours of difference). They measured the congruence of dominant and non-dominant hands performances. It was found that right (sub-dominant) hemisphere functions were affected mainly with acute desynchronosis while left hemisphere functions were acute with the latent desynchronosis. On the other hand the adjustment of left hemisphere perform in less deviations from the basic level.

Our study is also focused on the investigation of the proprioceptive regulation of the people in situation of the challenge to the psychological adjustment. We investigated the precision of proprioceptive regulation of fine motor skills in immigrants. Our goals were to check all movement types in lineograms, not only frontal, as well as drawing parallels, that are the base of the Proprioceptive Diagnostics of Temperament and Character, in order to see both the underlined cross-cultural differences in fine motor precision of right and left hand. Mira y Lopez and his followers, especially Tous (Tous Ral et al., 2012; Tous & Liutsko, 2014) underlined the performance of temperament features (more relevant to the nervous system characteristics) in the non-dominant hand (more often left hand, linked with the right hemisphere); and performance in the proprioceptive control of the precise motor skill of the features of character, which they described as more sensible to the actual, temporal “social” determination (right hand/left hemisphere for right-handers). The comparison of this explanation with the Russian psychological integrative theories (Merlin, 1986; Teplov, 1963; Nebylitsin, 1966) and multileveled models (Kovalev & Miasischev, 1967) of psychological individuality makes evident the similarity in basic ideas and differences in terminology. Though, the temperament, in tradition of Russian science (Pavlov, 1951), is linked with the characteristics of nervous system and character is the level of integrative psychic individuality, formed under the conditions of development, education, activity (Anan’ev, 1980; Kovalev & Miasischev, 1967).

In addition, the role of writing from right to left in Arabic in transversal movement performance should be considered in comparison with such in Spanish, with their culture of writing left-to-right. In general, all the possible differences defined in proprioceptive indicators of psychological differences can be explored as the basis for the elaboration of the approaches for treating the Arabic populations in their adjustment to the Spanish culture.

## Results

The ANOVA results showed the statistically significant cultural differences in the following proprioceptive movement types and dimensions of the Proprioceptive Diagnostics

of Temperament and Character<sup>5</sup> (all at s.l.  $p < 0.5$ ): Style of Attention (non-dominant hand), Decision Making (dominant hand), behavioural Rigidity/Variability (both hands) (Table 1).

Additionally, a discriminative analysis was performed; the results of which showed that both groups can be distinguished (Table 2) at statistically significant level  $p = 0.002$  and canonical correlation of 0.699 (Table 3).

## Discussion

For the first time the comparative analysis of fine motor precision tasks is done on immigrants (from Morocco) vs. Spaniards. The implications of its interpretations with help of the previous studies in this research line (M.K.P of Mira y López, 1958 and DP-TC of Tous et al., 2012). These interpretations are based on the balance of muscular and proprioceptive individual work, not verbal ones. For example, the tendency to Pessimism/Optimism (in their extreme values with more than  $\pm 2SDs$  – tendencies to Depression/Mania) are based on primary deviations in the Frontal movement since depends on internal energy of the person (Mira, 1958; Miroshnikov, 1963; Tous & Liutsko, 2014; Tous et al., 2012). All interpretations are referred to previous works (more than 300 in a total performed during the decades) (cited in Liutsko, 2014a).

Thus, as per differences in fine motor precision performance between both studied groups (immigrants and native residents of Spain) represented in Table 1, we can interpret in terms of methodology (DP-TC, M.K.P.) applied the following:

- (1) *Style of attention*: in the temperament (transversal movements represented by non-dominant hand, DT1, there were significant differences between both groups ( $F(1,53) = 4.01$ ,  $p < 0.05$ ), with a tendency to the left shift in mean value for Spanish group; whereas in character (movements represented by dominant hand, DT2, this difference was less and did not reach the statistical significance;
- (2) *Decision making*: If in the temperament (DS1) there were no significant differences between both groups; in character (DS2) Spanish group has higher tendency to dominance compared to immigrants ( $F(1,53) = 4.01$ ,  $p < 0.05$ );
- (3) *Variability or impulsivity in behaviour*: in both, temperament (LV1) and character (LV2) the immigrants showed more variable behaviour, also the difference was lower in the character hand:  $F(1,53) = 17.44$  vs.  $F(1,53) = 13.70$ ).

Taking into account the congruence in both hands performances (Table 1), in immigrants we can see, that in line length variability (LV) the high and significant differ-

<sup>5</sup> Temperament in original version by Tous was meant more stable characteristics of behaviour, whereas for character more flexible that reacted quickly on changes in the environment; similar to those effects that were observed also by Ezhov and Krivoshchekov (2004) in non-dominant and dominant hands.

**Table 1** Descriptive statistics and ANOVA results in differences of group's performances.

Bias type	MT/subtest (DP-TC)	Var	Group	M	SD	Cohen's d	ANOVA, <i>F</i> (1,53)
Directional	Frontal (Mood)	DF1	Sp	-6.97	16.31	-0.11	0.15
			Mr	-5.42	12.80		
		DF2	Sp	-5.48	12.36	-0.10	0.14
			Mr	-4.04	16.39		
	Transversal (Style of Attention)	DT1	Sp	-8.87	12.79	-0.55	<b>4.01*</b>
			Mr	-1.00	16.38		
		DT2	Sp	-4.23	7.97	-0.55	3.90
			Mr	0.88	11.18		
Sagittal (Decision Making)	DS1	Sp	14.55	12.34	0.01	0.00	
		Mr	14.46	9.82			
	DS2	Sp	16.55	10.04	0.64	<b>5.35*</b>	
		Mr	10.17	10.30			
Formal	Frontal (Emotivism)	FF1	Sp	10.58	7.27	0.35	1.56
			Mr	8.29	5.98		
		FF2	Sp	8.90	8.04	-0.30	1.19
			Mr	11.83	11.86		
Line length	Sum of all (Irritability)	LL1	Sp	38.29	10.28	-0.50	3.29
			Mr	43.38	10.36		
		LL2	Sp	37.23	9.19	-0.21	0.56
			Mr	38.92	6.97		
Line length variability	(parallels) (Rigidity/Variability)	LV1	Sp	12.58	6.34	-1.16	<b>17.44*</b>
			Mr	20.96	8.54		
		LV2	Sp	13.90	6.82	-1.03	<b>13.70*</b>
			Mr	21.63	8.66		

*Legend:* MT – movement type, DP-TC – dimensions of the Proprioceptive Diagnostics of Temperament and Character; Sp – Spain, Mr – immigrants from Morocco to Spain; Var – observable variables: DF1 and DF2 – directional bias, frontal movement; DT1 and DT2 – directional bias, transversal movement; DS1 and DS2 – directional bias, sagittal movement; FF1 and FF2 – formal bias, frontal movement; LL1 and LL2 – line length; LV1 and LV2 – line length variability; in all cases 1 is sub-index indicating non-dominant hand and 2-dominant. In bold: statistically significant differences.

ence appeared in both hands (in non-dominant,  $F = 17.44$  and dominant,  $F = 13.70$ ). This trend seemed to be persistent within immigration process and for this reason shows more specific cultural differences in fine motor performance in both groups. We can suggest that it can be due a specific trait of the persons who made the decision of migration to other country, showing that they could be more impulsive; however, as well more flexible and adaptable since LV dimension of DP-TC corresponds to behavioural variability and measures the balance between rigidity and variability.

The minimal differences in fine motor behaviour performance in immigrants from Morocco and Spaniards were observed in Directional bias of frontal movement in both hands (DF1 & DF2), that corresponds to Mood dimension of DP-TC and measures the tendency towards optimism or pessimism; as well as in sagittal movement type and non-dominant hand (DS1). However, in dominant hand (DS2) the significant difference was observed ( $F = 5.35$ ), indicating a tendency of immigrants to a less dominant behaviour (Decision making dimension in DP-TC) compared to the native residents. Since the difference occurs only in dominant hand, it corresponds more to the adaptive behaviour related to environmental changes.

Difference in the transversal movement performance (DT1 & DT2) was logical to expect due to cultural habit of writing from in inverse direction in Morocco immigrants (from right to left), still was conserving to some extent in

**Table 2** Matrix of structure of the discriminant function.

	Function
	1
LV1	0.586
LV2	0.519
DS2	-0.325
DT1	0.281
DT2	0.277
LL1	0.254
FF1	-0.175
FF2	0.153
LL2	0.105
DF1	0.054
DF2	0.052
DS1	-0.004

*Legend:* DF1 and DF2 – directional bias, frontal movement; DT1 and DT2 – directional bias, transversal movement; DS1 and DS2 – directional bias, sagittal movement; FF1 and FF2 – formal bias, frontal movement; LL1 and LL2 – line length; LV1 and LV2 – line length variability; in all cases 1 is sub-index indicating non-dominant hand and 2-dominant.

the dominant hand; also did not reach to statistically significant level compared to non-dominant hand performance (Table 1). Slight changes in the dominant hand performance

**Table 3** Resume of the canonical discriminative functions.

Autovalues				
Function	Autovalue	% of variance	% accumulated	Canonical correlation
1	.958	100.0	100.0	0.699
Wilks Lambda				
Contrast of functions	Wilks Lambda	Chi-square	df	Sig.
1	0.511	31.577	12	0.002

showed the possible acculturation and general adjustment process since some part of participants (younger) from this group were locally scholarized and for this reason used writing like in Spain (from left to right) also. This movement type is related to Extratension – Intratension balance in the dimension of Style of Attention in the DP-TC. The results showed tendency towards higher Extra-tension (attention to the external world) in both, temperament and character of immigrants compared to the mean values in these movements of Spaniards.

Formal deviation biases (FF1 & FF2) related to Emotivism dimension of the DP-TC (higher values are belong to more affective and with tendency to be affiliated people and low value show less affective and more independent ones) were expressed distinctly in non-dominant and dominant hand (inverse relationship). However, the size effects were low-medium and these differences did not reach the statistically significant level (Table 1).

Finally, the line length performance (LL1 & LL2) had a tendency to reproduce bigger sizes in the immigrant's group in non-dominant hand ( $43.38 \pm 10.36$  mm vs.  $38.29 \pm 10.28$  mm). Nevertheless this difference did not reached a statistically significant level; and it was reduced in the dominant hand, i.e., there was less difference in the absolute mean values between the both group's presentations ( $37.23 \pm 9.19$  mm vs.  $38.92 \pm 6.97$  mm). The higher line length performance reflects the higher trend to Excitability pole in the Irritability dimension of the DP-TC.

As per results of the discriminative analysis performed (Table 2), the highest weights in it were observed in the Line Length Variability in both, the non-dominant (0.586) and dominant (0.519) hands (LV1 and LV2; Rigidity/Variability dimension of the DP-TC). They were followed by Directional bias in Sagittal movement in the dominant hand ( $-0.325$ ; DS2; Decision Making dimension of DP-TC, in character) and then by the Directional bias in lineograms in transversal movement in both hands (0.281 and 0.277 for DT1 and DT2 correspondently; Inhibition-Excitability dimension of the DP-TC) (Table 2).

These results mirror and confirm the ANOVA results, emphasising that both immigrants from the Morocco can be discriminated from the Spaniards by the most significant DP-TC variables such as Variability/Impulsivity (in both – temperament and character) – line length variability – LV1 & LV2 and Decision Making – directional bias in sagittal movement in character only – DS2. Also, but to less extent, can be considered differences in transversal movement, slightly higher in non-dominant hand – DT1 (Table 2).

Among the most relevant to the problem of acculturation (Lebedeva, 1997; Stephanenko, 1999) results of our investigation we would like to underline the evidence of higher scores of variability in temperament of immigrants from Morocco that can be considered as special predisposition of the active migrants.

The results and interpretations of this study are based only of proprioceptive (miokinetic) test that has its own strengths and limitations. No verbal tests were performed in this study to see their results also since not all participants from Morocco knew local language. However, as per previous comparative analysis of the verbal tests vs. proprioceptive on personality outputs (Liutsko, 2014b), it was shown that these two methods could be dissociative to some extent due to the methodology itself (in verbal tests participants make fake the results due to social desirability, for example; whereas, the proprioceptive (miokinetic) ones are difficult or impossible to fake. Moreover, verbal tests would reflect more "what we are thinking about us" and proprioceptive (miokinetic) – more what are "our internal dispositions, conscious or not).

## Conclusions

Some cultural (or at least the specific features of the immigrant's subgroup of this culture), such as line length variability (LV), reflecting the higher behavioural variability, were more stable in the immigrants from Morocco origin in Spain compared to the native residents. The transversal movement also showed and confirmed the differences in habit of writing (in Arabic culture from the right to left) in non-dominant hand (that was less affected by life event changes). The decrease of this difference in the dominant hand (where it did not reach to be of significant level) showed the adaptive processes that could be explained by using writing habit from the left to right in immigrants especially in those who were working and studying locally and used this European style of writing with higher frequency.

The significant difference in sagittal movement (DS2) in dominant hand was an important and taken into account in the programs for better adaptation of immigrants in local culture since, as per the observed less dominance in the immigrant group, they need to compensate it in a constructive way (the inhibited behaviour to be shifted to the "healthy" portion of the dominance as assertiveness, for example).

The differences of temperament and character in immigrants in comparison with the native residents (detected with the method of proprioceptive diagnostics) were found in our study. As it was formulated in the works of physiologists and psychologists of different branches of Russian science, the differences in brain functioning, including interhemispheric relations (Chomskaya, Efimiva, Budyka, & Ezhov, 1997; Malova, 1991) make differences in the performance of the movements and also are reflected in the stress-resistance and adjustment to the desynchronization (Ezhov & Krivoshchekov, 2004).

The results of our investigation brings us to the conclusions.

1. The PD-TC method is sensitive to the differences in temperament and character (in terminology of the authors of the method) between dominant population of Spanish residents and non-dominant group of immigrants from Morocco.
2. In Immigrants from Morocco the influence of writing from right-to-left on the proprioceptive control in fine motor skills is more evident in non-dominant, left, hand – less dependent on actual social situation.
3. In practice of the psychological help to immigrants their variability as the feature of temperaments must be taken into account. Among the most sensitive and reasonable indicators of the effectiveness of the psych-social help the tendency to dominance in decision-making as the feature of the character should be considered.

In future more studies are recommended to be carried out in this direction (cross-sectional or longitudinal, as well as involving the psycho-genetic approach) in order to observe how the process of the adjustment is developing depending of the years of experiencing acculturation.

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