

# PERSONALITY TRAITS AND PERCEPTION OF MÜLLER-LYER ILLUSION IN MALE CHINESE MILITARY SOLDIERS AND UNIVERSITY STUDENTS

Yingchun Zhang<sup>1</sup>,  
Jing Liu<sup>1,2</sup>,  
Yongli Wang<sup>3,4</sup>,  
Jingyi Huang<sup>3</sup>,  
Lili Wei<sup>1</sup>,  
Bingren Zhang<sup>3</sup>,  
Wei Wang<sup>1,3</sup>,  
Wei Chen<sup>1\*</sup>

## Abstract

**Background:** In military men, performance such as gun-shooting precision relies on factors such as the ability to resist visual illusion, and this misperception of visual stimulus might be linked with sensation seeking related personality. **Methods:** We have invited 103 male military men and 104 age-matched university male students to undergo the experiment of the Brentano version of the Müller-Lyer illusion and the Zuckerman-Kuhlman Personality Questionnaire (ZKPQ) tests. **Results:** The military men scored significantly lower than students did on the ZKPQ Impulsive Sensation Seeking test but higher on Aggression-Hostility and Sociability test, and displayed less misperception magnitude to the illusion. The Impulsive Sensation Seeking, Neuroticism-Anxiety and Aggression-Hostility traits in military men, and the Activity in students were respectively correlated with the misperception magnitudes of the illusion in different manners. **Conclusion:** Limited results in our study have indicated that the military men had pronounced personality traits which were correlated with the misperception magnitude of the Müller-Lyer illusion.

## Keywords

• Male university students • Military men • the Brentano version of the Müller-Lyer illusion  
• the Zuckerman-Kuhlman Personality Questionnaire

<sup>1</sup> Department of Psychiatry, Sir Run Run Shaw Hospital, Zhejiang University College of Medicine, Hangzhou, China;

<sup>2</sup> Department of Psychiatry, Zhejiang Provincial Tongde Hospital, Hangzhou, China;

<sup>3</sup> Department of Clinical Psychology and Psychiatry/School of Public Health, Zhejiang University College of Medicine, Hangzhou, China;

<sup>4</sup> Department of Internal Medicine, Affiliated Hospital to No. 96162 Branch, the People's Liberation Army, Ganzhou, China.

Received 05 December 2016  
accepted 27 February 2017

## Introduction

Military training is the acquisition and development of a collection of physical and psychological attributes required in order to undertake waging war tasks [1]. The training curriculum for armed officers conceptually involves some forms of gradual exposure to a contextual environment in which basic skills, ideally learned in benign surroundings, can be applied in a more hostile setting [2]. In a battle scenario, military commanders must be able to visualize the battlefield in order to understand the changing situation. Better visualization, based on the most complete information, leads to better understanding of the situation and better decisions about what actions to take [3]. However, visual perception is rarely a true reflection of an object's physical characteristics but often biased by the spatial contexts surrounding the object [4], thus the ability of resisting illusion is of great significance for an individual, particularly for a gunner.


The Müller-Lyer illusion is a classical perception test which lies in the subject's judgment between two parallel lines that have the same size, one terminated with outward-pointing arrowheads, and the other with inward ones. The Brentano or combined form of this illusion is one version which uses three fins along the shaft and brings about a misjudgement of the subjective center. In this case, one half of the line with outward-pointing fins seems to be compressed whereas the other half with inward-pointing fins seems to be expanded (Figure 1). Some theories have been used to explain the misperceptions of the Müller-Lyer illusion, including strategic elements [5] and physiological mechanisms such as the lateral inhibition within the cortex [6], and optical blurring [7]. Coren additionally proposed an efferent theory to explain the illusion, which describes a motoric interaction of the response on visual impression in consciousness [8]. The Müller-Lyer illusion continues to attract empirical and theoretical

interests due to its exemplar status for demonstrating the mismatch between "reality" and perception that can occur in everyday visual processing [9].

In normal people, the Müller-Lyer illusion has been used to influence the perception of target location in the context of manual aiming [10-12]. Normal personality traits, on the other hand, have been shown to influence the perception of the illusion [13,14]. In personality evaluations, the Zuckerman-Kuhlman Personality Questionnaire (ZKPQ) is an instrument designed to describe the five-factor model of the individual trait structure [15], which measures Impulsive sensation seeking, Neuroticism-anxiety, Aggression-hostility, Activity and Sociability. The questionnaire might be used to characterize people who display different illusion perceptions.

Bearing the above documentation in mind, one might raise a question whether in male participants who have higher traits of Impulsive sensation seeking [16], Aggression-hostility or

\* E-mail: srrcw@zju.edu.cn

 © 2017 Yingchun Zhang et al., published by De Gruyter Open.

This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivs 3.0 License.

antisocial trend [17], might be found more specifically in military men, or the relationship between personality traits and the illusion perception would be clearer. Therefore, in the current study, we have hypothesized that (1) military male soldiers are more resistant to illusion than the male university students; (2) the resistance to illusion is associated with lower Impulsive Sensation Seeking, lower Neuroticism-Anxiety and lower Aggression-Hostility traits, especially in military men.

## Methods

### Participants

The study was conducted in male participants only: 103 military men (mean age 20.15 years old with 1.54 S.D., age range 17 to 25 years) and 104 university students (mean age  $19.77 \pm 1.83$ ; age range 18 to 28). Their mean ages were not significantly different from each other ( $t = 1.62$ ,  $p = 0.107$ ). The military men were recruited from a military station, who had experienced shooting training of up to three months. The students were recruited from a university, and they also had experienced some military training (including shooting) for two weeks at the very beginning of their university life. The visions of the military men were normal, and of students were normal or corrected to normal. All participants were physically healthy, free from any psychiatric or neurological disorders, and were abstained from alcohol or other psychotropic medication for 72 hours prior to the test. The study protocol was approved by the Medical Ethics Committee of School of Public Health, Zhejiang University and all participants had given their written informed consents. For participants of 17 years old, we have obtained the written informed consent by their next of kin, through a surrogate consent procedure, regarding participating in our study.

### Measures

Participants completed the following three questionnaires in a quiet room.

A. The Zuckerman-Kuhlman Personality Questionnaire [15]. The test includes five dimensions: (a) Impulsive sensation seeking (19 items); (b) Neuroticism-anxiety (19 items); (c) Aggression-hostility (17 items); (d) Activity (17

items); and (e) Sociability (17 items). One point is given to each chosen item corresponding to personality traits. In this questionnaire, ten items of another scale of dissimulation (infrequency or lie) were randomly inserted into the test body. Any score above 3 on the infrequency scale suggests that either inattention to the content of the items and acquiescence or a very strong social desirability set; therefore, the infrequency scale was used as a test validity indicator for individuals. The ZKPQ has proven to be reliable in Chinese culture [18].

B. The Plutchik - van Praag Depression Inventory (PVP)[19]. This test was developed on the basis of depressive symptoms often described in mental disorders, and each of its 34 items has three scale points (0, 1, 2) corresponding with increasing depressive tendencies. Participants have "possible depression" if they score between 20 and 25 or "depression" if they score above 25. The inventory has proven to be reliable in Chinese culture [20].

C. The Brentano version of the Müller-Lyer illusion. In the present study, the formation was based on two equal segments of 3.5 cm long, the fins were shorter lines (0.5 cm) of a  $45^\circ$  (ingoing) or  $135^\circ$  (outgoing) angle (Figure 1). The changing forms of the illusion were reflected in two conditions. In one condition, the left segment was closed and the right open, the length of the left segment was always fixed as 100%, the shortening of the right segment was successively in a scale of 1% to 32% (i.e., 99% to 68%, LCRO-StoL-32, Figure 1a) or the elongating of the right was of 1% to 5% (i.e., 101% to 105%, LCRO-EtoR-5, Figure 1b). Similarly, in another condition, the left segment was open and the right closed, the length of the left segment was always fixed as 100%, the shortening of the right segment was successively in a scale of 1% to 5% (i.e., 99% to 95%, LORC-StoL-5, Figure 1c) or the elongating of the right was of 1% to 32% (i.e., 101% to 132%, LORC-EtoR-32, Figure 1d). The rationale to select 1-32% of change was based on Weber's Law of the just noticeable difference [21]. Altogether, 74 compositions of the modified Brentano version of the Müller-Lyer illusion, together with the two original compositions

(altogether 76), were randomly listed on four A4 size papers, one below the other, with an equal space in between. All lines were drawn in black against a white background. The subjects were asked to judge whether the left segment was shorter than, equal to or longer than its adjacent right segment in length in a composition. If a participant had made three consecutively incorrect judgments in a row (i.e., the participant had perceived an illusion three consecutive-times in a row) in a given condition from LCRO-StoL-32, LCRO-EtoR-5, LORC-StoL-5, or LORC-EtoR-32, we considered the answers to the questionnaire as invalid and the respective data from that individual was disregarded. If a participant had made two consecutively correct judgments in a given condition, we would take the value which was closer to 100% as the misperception magnitude of that individual. The closer to 100% the misperception magnitude a participant identified, the stronger ability he held to resist the illusion. In other words, for elongating condition (LCRO-StoL-32 and LORC-EtoR-32, Figure 1a,d), the more extension to the right side, the weaker ability to resist the illusion; and for shortening condition (LCRO-EtoR-5, LORC-StoL-5, Figure 1b,c), the more shrinkage to the left, the weaker ability to resist the illusion.

### Statistics

The mean ages and PVP scores in the two groups were analyzed by the independent Student t test. The mean percentages of misperception magnitude and the mean ZKPQ scale scores were analyzed by two-way ANOVA followed by the post-hoc Student t test plus the Bonferroni correction. In addition, the Spearman rank order correlation test was applied to analyze the relationships between ZKPQ, PVP scale scores and the misperception magnitudes of the Müller-Lyer illusion. The alpha level of significance was set at 0.05.

### Results

The mean PVP scores in the two groups were statistically similar (military men,  $9.50 \pm 4.55$  vs. students,  $8.25 \pm 4.95$ ;  $t = 1.89$ ,  $P = 0.061$ ; 95% CI: -0.06 ~ 2.55). Individual PVP data have shown that all participants had scored less than

20. There was however, a significant difference between the ZKPQ trait scores in the two groups ( $F[1, 205] = 4.653$ ,  $MSE = 61.414$ ,  $P = 0.032$ ). The military group scored significantly lower on Impulsive Sensation Seeking ( $P = 0.035$ , 95% CI:  $-1.92 \sim -0.07$ ), but higher on Aggression-Hostility ( $P = 0.000$ ; 95% CI:  $1.06 \sim 2.41$ ) and Sociality ( $P = 0.000$ , 95% CI:  $0.87 \sim 2.69$ ) (Table 1). There was also a significant difference regarding the misperception magnitude of the Müller-Lyer illusion between the two groups (one-way ANOVA,  $F[1,77] = 9.21$ ,  $MSE = 53.45$ ,  $P = 0.003$ ). Military men displayed significantly lower mean LORC-EtoR-32 value (less prolonged or more approaching to 100%,  $123.13$ ;  $P = 0.046$ , 95% Confidence Interval (CI):  $-3.85 \sim -.03$ ) than students did ( $125.07$ ) (also see Table 1).

In the military group, ZKPQ Impulsive Sensation Seeking was positively correlated with LORC-EtoR-32 ( $n = 103$ ,  $r = 0.36$ ,  $P < 0.01$ ), and negatively with LCRO-StoL-32 ( $r = -0.26$ ,  $P < 0.05$ ); Neuroticism-Anxiety was negatively with LCRO-StoL-32 ( $r = -0.35$ ,  $P < 0.01$ ); and Aggression-Hostility was positively correlated with LCRO-EtoR-5 ( $r = 0.25$ ,  $P < 0.05$ ). In students, Activity was positively correlated with LCRO-StoL-32 ( $n = 104$ ,  $r = 0.28$ ,  $P < 0.05$ ) (Table 2).

## Discussion

Compared with students, military men scored significantly lower on the ZKPQ Impulsive Sensation Seeking, but higher on Aggression-Hostility and Sociality, and displayed less misperception magnitude to the Brentano version of the Müller-Lyer illusion (in the LORC-EtoR-32 condition), which supported our first and partly our second hypotheses. In military men, the Impulsive Sensation Seeking, Neuroticism-Anxiety and Aggression-Hostility traits were respectively correlated with the misperception magnitudes of the illusion in different manners; while in students, Activity was correlated with the magnitude of the LCRO-StoL-32 condition. This was the first study using the continuous changing forms of the Brentano version of the Müller-Lyer illusion to correlate the illusion misperception magnitude with the personality trait.

Previous researches of the five-factor model of personality have shown some pronounced traits, such as neuroticism and conscientiousness in trained or being trained military men [22]. In our study using the alternative five-factor model, the Impulsive sensation seeking was lower in military men, which was in line with the self-discipline and military bearing of soldiers associated with commendations [23]. In this sense, we might speculate that the compliance and the planning ahead gained through the military life result in less impulsivity and lower Impulsive sensation

seeking. However, our results were contradictory with a previous investigation showing that the policemen displayed higher Impulsive sensation seeking trait [24]. The differences might be caused by the fact that the policemen were not military men, and that the control group recruited in Próchniak [24] was lower risk-taking individuals. Thus, the controversies between this study and ours need to be clarified further.

On the other hand, the military men are trained to show their aggression outward and their obedience and compliance with rules

**Table 1.** Scale scores (Mean  $\pm$  S.D.) of the Zuckerman-Kuhlman Personality Questionnaire and the misperception magnitude (in %) of the Müller-Lyer illusion in military ( $n = 103$ ) and student ( $n = 104$ ) groups.

	Military	Students
The Zuckerman-Kuhlman Personality Questionnaire		
Impulsive sensation seeking	8.22 $\pm$ 3.24	9.22 $\pm$ 3.50*
Neuroticism-anxiety	6.79 $\pm$ 3.58	7.03 $\pm$ 3.63
Aggression-hostility	6.46 $\pm$ 2.58	4.72 $\pm$ 2.37*
Activity	7.93 $\pm$ 3.16	7.77 $\pm$ 3.37
Sociability	8.94 $\pm$ 2.98	7.16 $\pm$ 3.63*
The Illusion Misperception Magnitude		
LCRO-StoL-32	76.48 $\pm$ 5.97	77.00 $\pm$ 6.41
LCRO-EtoR-5	101.18 $\pm$ 0.65	101.13 $\pm$ 0.57
LORC-StoL-5	98.89 $\pm$ 0.53	98.92 $\pm$ 0.45
LORC-EtoR-32	123.13 $\pm$ 4.85	125.07 $\pm$ 5.79*

Note: \*  $p < 0.05$  vs Military; for full explanations of LCRO-StoL-32, LCRO-EtoR-5, LORC-StoL-5 and LORC-EtoR-32, please see text and Figure 1.

**Table 2.** Correlation matrix between scales of the Zuckerman-Kuhlman Personality Questionnaire and the misperception magnitude of the Müller-Lyer illusion in military and student groups.

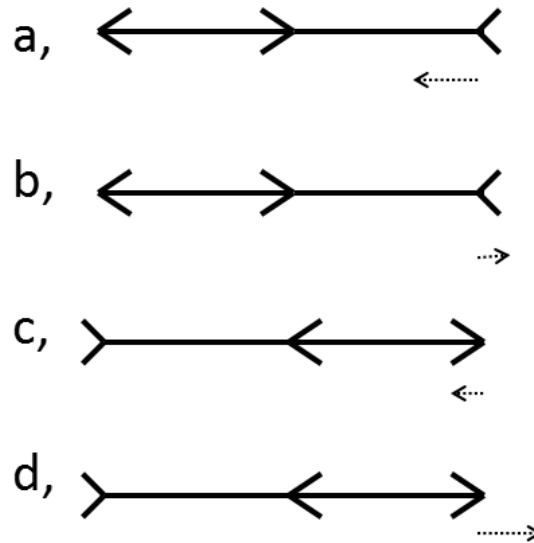
	LCRO-StoL-32	LCRO-EtoR-5	LORC-StoL-5	LORC-EtoR-32
Military ( $n = 103$ )				
Impulsive sensation seeking	-.26*	.16	-.07	.36*
Neuroticism-anxiety	-.35*	.05	-.14	.11
Aggression-hostility	-.11	.25*	.02	-.05
Activity	.05	-.08	-.17	-.02
Sociability	.10	-.02	.14	.03
Students ( $n = 104$ )				
Impulsive sensation seeking	.06	-.12	.16	.10
Neuroticism-anxiety	.09	-.15	.03	-.12
Aggression-hostility	.11	.11	.04	.01
Activity	.40*	.01	.12	-.19
Sociability	.04	.17	-.05	-.02

Note: \*,  $p < 0.05$ ; for full explanations of LCRO-StoL-32, LCRO-EtoR-5, LORC-StoL-5 and LORC-EtoR-32, please see text and Figure 1.

inward [25], which might partly be the reason that they displayed pronounced Aggression-hostility trait in the present study. Again in Oltmanns et al. (2004)'s study, some soldiers had higher antisocial traits which influenced their later military life. Regarding the higher Sociability in military men found in our study, there was no direct evidence supporting the outcome in the literature. There was, however, one study showing that more outgoing individuals would like to be recruited as policemen [26], which might help to explain the higher Sociability trait found in our military men.

Interestingly, we found a lower magnitude of LORC-EtoR-32 misperception in the military men, which signified that their ability to resist the illusion was enhanced. Again, there is no direct literature-comparison available to this finding. The obligatory military training might be one of the reasons, since the shooting training in policemen resulted in increased pointing accuracy [27]. Military training in the open field is often connected with different environment conditions, which might assign more cortical adjustments in military men. This physiological-related postulation is in line with the lateral inhibition theory of illusion perception [6]. On the other hand, the LORC-EtoR-32 misperception magnitude was positively correlated with the Impulsive sensation seeking in military men, indicating that the lower Impulsive sensation seeking decreased the misperception magnitude of the illusion. The correlation was in line with a study showing that the sensation seeking trait was negatively correlated with soldiers' perception of situation structure in a military environment [28]. Moreover, higher attention-manipulation reduced the susceptibility of the Müller-Lyer illusion in normal people [7].

In military men, the Neuroticism-anxiety was negatively correlated with the misperception magnitude of LCRO-StoL-32 condition, indicating that higher anxiety increased the misperception of the illusion. The correlation was inconsistent with the similar Neuroticism-anxiety scores in the two groups, but up to the present there is no plausible explanation for it, although the different military training experiences in the two groups might contribute



**Figure 1.** The Brentano version of the Müller-Lyer illusion (with left segment always fixed to 100% in each combination): a, left segment closed, right open, and right segment can be shortened to the left side from 99% to 68% (in 1% step, altogether 32 combinations), called LCRO-StoL-32; b, left segment closed, right open, and right segment can be elongated to the right side from 101% to 105% (in 1% step, altogether 5 combinations), called LCRO-EtoR-5; c, left segment open, right closed, and right segment can be shortened to the left side from 99% to 95% (in 1% step, altogether 5 combinations), called LORC-StoL-5; d, left segment open, right closed, and right segment can be elongated to the right side from 101% to 132% (in 1% step, altogether 32 combinations), called LORC-EtoR-32.

to the correlation. However, this outcome was in accordance with that participants with higher anxiety making more errors in the illusion perception [29], and with policemen with higher anxiety displaying less shooting accuracy [30]. We also found that Aggression-hostility was positively correlated with the misperception magnitude of LCRO-EtoR-5 in soldiers, indicating that higher Aggression-hostility trait was associated with decreased magnitude of misperception of the illusion. Although there lacks a direct literature support, two lines of evidence might support our finding, i.e., the patients with autistic diagnosis or with higher autistic score had displayed less susceptibility to the illusion [31,32], and most patients with autism presented aggressive behaviors [33].

Different from that in the military men, Activity was positively correlated with the misperception magnitude of LCRO-StoL-32 in students, indicating the higher the Activity the greater the resistance to the illusion. The correlation was again inconsistent with the

similar Activity scores in the two groups, but up to the present there is no plausible explanation for it either, and we might speculate further that it was partly due to the less military training experience in students. Nevertheless, one study has shown that academically stimulated students show more activity, and mobilized them to strive, change, and elevate self-perception [34], which might imply that they had paid more attention to the academic performance probably including the illusion perception. Indeed, the hyperactive boys were more resistant to the Müller-Lyer illusion [35].

One should also notice the limitations of the current study. Firstly, we only included male participants, our results therefore lack a generalizability across genders. Secondly, the sample sizes of our study were relatively small, and the results should be further-validated by other independent laboratories worldwide, for instance, we only detected one significant illusion perception difference (out of four structures) between the two groups, and only five significant correlations

between illusion perceptions and personality traits (altogether 40 relationships) among the two groups. Thirdly, we did not notice the detailed military training information, so its exact contribution to the current results remains unsettled. Nevertheless, we have demonstrated that the military men had pronounced personality traits, some of which were correlated to the misperception magnitude of the Müller-Lyer illusion. Future studies might direct a search for the high-level or cognitive factors toward the illusion, concerning both personality (for instance, all traits including sociability) and physical training in normal people and in military men.

## Acknowledgements

The study was supported by a grant from the National Natural Science Foundation of China (No. 91132715) to Dr. W. Wang., and a key project from the Researches on the Medicine, Pharmacy and Health of Zhejiang Province to Dr. W. Chen (No. 2015ZDA016). YZ and JL contributed equally to the work described in the report.

## Authors' Declarations

Regarding research work described in the paper, each one of our co-authors, Yingchun Zhang, Jing Liu, Yongli Wang, Jingyi Huang, Lili

Wei, Bingren Zhang, Wei Wang, and Wei Chen, declares that there is no conflict of interest, and conformed to the Helsinki Declaration concerning human rights and informed consent, and followed correct procedures concerning treatment of humans in research.

## Authors' Contribution

WW and WC conceived the study, YZ, JL, YW, JH, LW and BZ collected the data, YZ and JL analyzed the data, YZ, JL and WW drafted the paper.

## References

- [1] Beevor. Inside the British Army. London : Corgi.1991.
- [2] Taverniers & De Boeck, P. Force-on-Force handgun practice: an intra-individual exploration of stress effects, biomarker regulation, and behavioral changes. *Hum Factors*.2004,56(2), 403-413.
- [3] Thomas, L. C., & Wickens, C. D. Effects of battlefield display frames of reference on navigation tasks, spatial judgements, and change detection. *Ergonomics*. 2006, 49(12-13), 1154-1173.
- [4] Schwartz, O., Hsu, A., & Dayan, P. Space and time in visual context. *Nat Rev Neurosci*. 2007,8(7), 522-535.
- [5] Coren, S. & Porac C.. Structural and cognitive components in the Müller-Lyer illusion assessed via cyclopean presentation. *Perception & Psychophysics*, 1984,35(4), 313-318.
- [6] Coren, S., Porac, C., Aks, D. J., & Morikawa, K. A method to assess the relative contribution of lateral inhibition to the magnitude of visual geometric illusions. *Perception and Psychophysics*, 1988,43(6), 551-558.
- [7] Coren, S., & Porac C. The creation and reversal of the Müller-Lyer illusion through attentional manipulation. *Perception*, 1983,12(1), 49-54.
- [8] Coren, S. An efferent component in the visual perception of direction and extent. *Psychological Review*, 1986,93(4), 391-410.
- [9] Predebon, J. Selective attention and asymmetry in the Müller-Lyer illusion. *Psychonomic Bulletin & Review*, 2004,11(5), 916-920.
- [10] Elliott, D., & Lee, T. D. The role of target information on manual-aiming bias. *Psychological Research*, 1996,58(1), 2-9.
- [11] Westwood, D. A., Heath, M., & Roy, E. A. The effect of a pictorial illusion on closed-loop and open-loop prehension. *Experimental Brain Research*, 2000,134(4), 456-463.
- [12] Shehab, N. H. The effect of age and sex upon the Mueller-Lyer and Horizontal-Vertical illusion. *Arab Journal for the Humanities*, 2001,19, 289-300.
- [13] Grimbeek, P., Jamieson, G. A., & Gow, K. Using Structural Equation Modeling to Examine McCollough Effects (Orientation-Contingent Color Aftereffects): Influence of Dissociative Experiences and Age on Illusory Aftereffects. *International Journal of Clinical and Experimental Hypnosis*, 2011,59(2), 198-210.
- [14] Marotta, A., Tinazzi, M., Cavedini, C., Zampini, M., & Fiorio, M. Individual Differences in the Rubber Hand Illusion Are Related to Sensory Suggestibility. *PLoS one*,2016,11(12):e0168489. (DOI:10.1371/journal.pone.0168489).
- [15] Zuckerman, M., Kuhlman, D.M., Joreman, J., Teta, P., & Kraft, M. A comparison of three structural models for personality: The big three, the big five and the alternative five. *Journal of Personality and Social Psychology*,1993, 65(4), 757-768.
- [16] Mehmood, S.I., Khan, M.A., Walsh, K.M., & Borleffs, J.C. Personality types and specialist choices in medical students. *Med Teach*, 2013,35(1), 63-8.
- [17] Yu, R., Yu, S., Liu, Y., Chen, W., Shen, M., Wang, D., & Wang, W. Adjectival descriptors for antisocial personality trait in Chinese university students. *Journal of Personality Disorders*,2009, 23, 661-668.
- [18] Wu, Y., Wang, W., Du, W., Li, J., Jiang, X., & Wang, Y. Development of a Chinese version of the Zuckerman-Kuhlman Personality Questionnaire: Reliabilities and gender/age effects. *Social Behaviour and Personality*,2000, 28(3), 241-250.
- [19] Plutchik, R., & Van Praag, H. M. Interconvertibility of five self-reported measures of depression. *Psychiatry Research*,1987, 22(3), 243-256.
- [20] Wang, W., Cao, M., Zhu, S., Gu, J., Liu, J., & Wang, Y. Zuckerman-Kuhlman's Personality Questionnaire in patients with major depression. *Social Behavior and Personality*, 2002,30, 757-764.
- [21] Booth, D.A., & Freeman, R.P.J. Discriminative measurement of feature integration in object recognition. *Acta Psychologica*,1973, 84, 1-16.

- [22] Hartmann, E., Sunde, T., Kristensen, W. & Martinussen, M. Psychological measures as predictors of military training performance. *Journal of Personality Assessment*, 2003,80(1), 87-98.
- [23] Bilgic, R., & Sümer, H. C. Predicting military performance from specific personality measures: A validity study. *International Journal of Selection and Assessment*, 2009,17(2), 231-238.
- [24] Próchniak, P. Polish police officers: Personality and risk taking. *Journal of Police and Criminal Psychology*, 2009, 24(2), 104-107.
- [25] Oltmanns, T. F., Fiedler, E. R., & Turkheimer, E. Traits associated with personality disorders and adjustment to military life: Predictive validity of self and peer reports. *Military Medicine*, 2004, 169(3), 207-211.
- [26] Burbeck, E., & Furnham, A. Personality and police selection: Trait differences in successful and non-successful applicants to the metropolitan police. *Personality and Individual Differences*, 1984,5(3), 257-263.
- [27] Nieuwenhuys, A., & Oudejans, R. R. D. Effects of anxiety on handgun shooting behavior of police officers: A pilot study. *Anxiety, Stress and Coping*, 2010,23(2), 225-233.
- [28] Parmak, M., Mylle, J. J. C., & Euwema, M. C. Personality and the perception of situation structure in a military environment: seeking sensation versus structure as a soldier. *Journal of Applied Social Psychology*, 2013,43(5), 1040-1049.
- [29] Stuchlikova, I. Trait anxiety and perceptual distortion. *Studia Psychologica*, 2000,42, 55-60.
- [30] Nieuwenhuys, A., & Oudejans, R. R. D. Effects of anxiety on handgun shooting behavior of police officers: A pilot study. *Anxiety, Stress and Coping*, 2010,23(2), 225-233.
- [31] Ropar, D., & Mitchell, P. Susceptibility to illusions and performance on visuospatial tasks in individuals with Autism. *Journal of Child Psychology and Psychiatry*, 2001,42(4), 539-549.
- [32] Chouinard, P. A., Noulty, W. A., Sperandio, I., & Landry, O. Global processing during the Müller-Lyer illusion is distinctively affected by the degree of autistic traits in the typical population. *Experimental Brain Research*, 2013,230(2), 219-231.
- [33] Matson, J.L., & Cervantes, P.E. Assessing aggression in persons with autism spectrum disorders: an overview. *Res Dev Disabil*, 2014, 35 (12), 3269-75.
- [34] De Guzmán, I.N., Calderón, A., & Cassaretto, M. Personalidad rendimiento académico en estudiantes universitarios. *Revista de Psicología*, 2003, 21(1), 119-143.
- [35] Houghton, R. R., & Tabachnick, B. G. Müller-Lyer illusion in hyperactive boys. *Journal of Learning Disabilities*, 1979, 12(2), 77-81.