National and Kapodistrian University of Athens

Medical School, First Department of Neurology

Director ProfessorLeonidas Stefanis

Postgraduate program in - Cognitive sciences – Clinical Neuropsychology

Final Year Project

Normative Data of the Brief Visuospatial Memory Test – Revised (BVMT-R) in the Greek Population

FilisiaChomata

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ABSTRACT

Background. The BVMT-R, an evolution of the original test, is a visuospatial memory test that evaluates immediate, delayed and recognition memory.Though, BVMT-R is a visual-graphic test and someone could claim that it should not be affected by lingual diversity, literature contains data that supports the effect of demographic factors(age, gender, level of education, language, culture, urban versus rural populations etc.).These studies indicated the need for validation of neuropsychological tests in the target population. To our knowledge, there are no normative data regarding the BVMT-R concerning the Greek population.

Aim. The aim of our study was the development of norms and the examination of the effect of certain demographic factors (age, gender and education) on the performance on the test for the Greek population.

Methods. This was an observational descriptive study. 381 participants were recruited from the general population with the convenience sampling method and subdivided in groups regarding gender , age, and education.Participants received a battery of four tests including all the phases of the BVMT-R test within about twenty five minutes. Descriptive analyses were performed to explore distribution of age, education, gender and hand preference within the sample. Multiple linear regression analyses were performed to explore the effect of demographic variables (age, educational level and gender) on BVMT-R performance.

Results. Results of the multiple linear regression analyses indicated that the model explained 48.9% and 48.0% of the variance of the Total and the Delayed Recall score of the BVMT-R respectively and that the model was a significant predictor for both of them.One-way ANOVAS revealed a significant effect of age and level of education in all BVMT-R scores with the exception of Response Bias. Finally, a 2-sample t-test did not reveal any statistical significant differences between genders.

Conclusion. Our study confirmed the findings of previous studies showing a significant effect of age and level of education on performance and yielded BVMT-R norms that can be applied in the Greek population.

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1. Introduction

1.1 Visuospatial ability

Visuospatial ability briefly refers to an individual's capacity to identify visual and spatial relationships in his environment. The visuospatial function relies on complex cognitive processes necessary to identify, integrate, and analyze space and visual form, details, structure and spatial relations in multiple dimensions. Thesespatial abilities are critical to functional independence. They allow us to locate targets in space, visually perceive objects, and understand the two- and three-dimensional (2D and 3D) spatial relationships among objects and our environment. These abilities allow us to safely navigate our environment through the accurate judgment of direction and distance(de Bruin, N., Bryant, D. C., MacLean, J. N., & Gonzalez, C. L. 2016).Impaired visuospatial skills can be very incapacitating and result in, for example, poor driving ability or difficulty navigating in space. The visuospatial skills are impaired from various clinical conditions such as trauma, stroke, dementia etc.Clinicians observed that the clinical course of patients undergoing cognitive rehabilitation was largely consistent with their performance on memory tests and consequently emerged the idea of the practical effects of these tests (Benedict, 1988).

1.2 The Brief Visuospatial Memory Test (BVMT and BVMT-Revised)

The Brief Visuospatial Memory Test (BVMT) was developed by Benedict several decades ago in an urgent need to establish a simple and compact neuropsychological test that could reliably evaluate the course of patients with cognitive disorders. The BVMT is the final product of several years of research that concentrated the existed knowledge and practice of older tests in a new powerful, compact and refined tool. The validity and reliability of the test was assessed and approved to be satisfactory (inter-rater reliability coefficient Pearson's $r > 0.8$, concurrent validity with Weschler Memory Scale; Benedict, R. H., & Groninger, L., 1995).

The original BVMT after its use in the early years appeared to present certain limitations: firstly, it was not very sensitive to subtle changes in performance, secondly the subject's fluctuations in attention seemed to affect their performance, assessment of learning was missing and finally the exclusion of recognition tests was deemed to be problematic. Most of these problems were addressed with a revision of the test that appeared several years later and has been used the last few decades with very satisfactory results (BVMT-R; Benedict, Schretlen, Groninger, Dobraski&Shpritz, 1996). In this revised test, a second administration procedure was inserted to assess learning over successive trials, a recognition trial was added and the scoring system had been changed aiming to increase its sensitivity in subtle changes.

The BVMT-R is a visuospatial memory test that evaluates immediate, delayed and recognition memory. The patients are shown a display of six figures, arranged in a 2 X 3 matrix for 10 seconds. After 10 seconds, the matrix is removed from sight and patients are asked to recall and reconstruct the figures from memory. Learning is assessed with two additional 10 second exposures of the matrix, followed by a delayed recall and a recognition trial. Delayed recall is evaluated 25 minutes later with figure drawing without any further exposure to the matrix. Scoring is based on the individuals' accuracy of drawing the figures. Finally, a recognition trial follows, in which patients are asked to identify figures shown to them previously. Six equivalent forms can be used to assure that prior exposure will not confound the results (Benedict, 1997). Scoring is based on the accuracy of drawing and the correct location of the drawing. Full credit (two points) is received when both criteria are met, one point for either correct position or correct drawing and zero points for missing or unidentifiable objects.

1.3 **Normative data of the BVMT-R**

Originally the test has been validated with normative data from an English-speaking sample, with researchers concluding that education and gender did not influence results. Only correction for age revealed to be important (Benedict & Groninger, 1995).

Though, BVMT-R is a visual-graphic test and someone could claim that it should not be affected by lingual diversity, literature contains data that supports the effect of demographic factors(language, culture, urban versus rural populations

etc.)on both verbal and visual tests (Perkins & Deregowski, 1982). Even more, it has been shown that factors associated with cultural diversity affect performance on the specific test (Pineda et al., 2000). Based on this information and accounting for the increasing numbers of Spanish-speaking population in the US the test was validated for the specific population and norms for this population were generated (Cherner et al., 2007). The results of this study revealed that education played a significant role in this population and also other unidentified cultural factors such as religion, language, financial status, ethics and values etc., that affect performance are discussed. A more recent publication strongly considers the influence of demographic factors such as age, education and race/ ethnicity on performance on these tests, with the latter viewed as a proxy for other factors such as academic exposure, education quality, academic resources, acculturation, socioeconomic status, social exposure, societal discrimination etc.(Norman et al., 2011).A validation of the test in the Brazilian population presented similar resultsshowing that age as well as education affected performance on the test (Miotto et al., 2012). These studies indicated the need for validation of neuropsychological tests in the target population in general.

The BVMT-R is used either independently or as part of theBrief International CognitiveAssessment for Multiple Sclerosistest (BICAMS)which includes the Symbol Digit Modalities Test (SDMT), thesecond edition of the California Verbal Learning Test (CVLT2) and the revised Brief Visuospatial Memory Test (BVMT-R) and evaluates an over-all cognitive function.Several countries, including Greece, have validated the BICAMStest for their population (Niino et al., 2017; Ozakbas et al., 2017; Polychroniadou et al., 2016; Sousa et al., 2018), while there is not much data on validation of the BVMT-R alone (Argento et al., 2016; Cherner et al., 2007; Miotto et al., 2012). Since this test has a significance of its own in different clinical settings and, as has been aforementioned, demographic factors affect the performance of the test, it seems prudent to use normative data of the population for which the test will be aimed at.

To our knowledge, there are no normative data regarding the BVMT-R concerning the Greek population. The aim of our study was the development of such norms and the examination of the effect of certain demographic factors (age, gender and education) on the performance on the test for the Greek population.

2. Method

2.1 Design. This was an observational descriptive study.

2.2 Participants. The participants were recruited from the general population with the convenience sampling method and subdivided in groups regarding gender (two groups: male and female), age (six groups: 16-22, 23-29, 30-39, 40-49, 50-59, 60+ years of age) and education (three groups: 0-9, 10-12, 13+ years of education). Inclusion criteria were the absence of any neurological or psychiatric disorder after careful screening including the Mini Mental State Examination (MMSE; Folstein et al., 1975). This categorization yielded a sum of 36 groups of at least 10 participants each resulting in a total number of minimum 360 participants.Due to difficulties in recruiting participants in the 16-49 age groups with 0-9 years of education, we excluded the 0-9 education groups for the ages 16-49 from the study. In the remaining 28 groups with a minimum of ten participants per group leading to a total of a minimum of 280 participants, we finally recruited 381 participants.

2.3 Procedures. Participants wereprovided with an information letter describingthe aims of the research and the procedure.An informed consent form was signed by all the participants.Participants received a battery of four testsincluding all the phases of theBVMT-R test within about twenty five minutes.The three other tests, none of which had a visuospatial component to avoid conflict, were administered between the immediate and delayed recall phases for distraction purposesand in order to have the necessary 25 minutes between them.For BVMT-R, six geometric designs(APPENDIX A) were shown to the participants for 10 seconds, and afterward, they were asked to reproduce as many of the designs as possible. The test includedan immediate recall phase (three trials), a delayed recall (after 25 minutes) and a recognition trial.

2.4 Statistical analysis. An SPPS IBM version 21 software was used for statistical analysis. Descriptive analyses were performed to explore the distribution of age, education, gender and hand preference within the sample.Multiple linear regression analyses were performed to explore the effect of demographic variable (age, educational level and gender) on BVMT-R performance. The sample was divided into

six age groups: 16-22, 23-29, 30-39, 40-49, 50-59 and 60+ years of age and was further classified into three educational levels: 0-9, 10-12 and 13+ years.

3. RESULTS

3.1 General DemographicData

Descriptive analyses were performed to explore the distribution of age, education, gender and hand preference within the sample (Table 1).

Table 1

General demographic data.

	N = 381		
AGE(in years; M, SD, Min, Max)	44.7±18.6 (MIN:16; MAX:87)		
EDUCATION(in years; M, SD, Min, Max)	13±3.2 (MIN:0; MAX:16)		
GENDER (n, %)	MALES 171 (44.8%)	FEMALES 211 (55.2%)	
HAND PR (n, %)	RIGHT 347 (90.8%)	LEFT 28 (7.3%)	AMBI 7 (1.8%)

Note. M = Mean; SD = Standard Deviation; Min = Minimum; Max = Maximum; Hand Pr = Hand preference; Ambi = Ambidextrous

Table 2 describes the demographic characteristics by all six age groups, three educational levels and two genders.

Table 2

Distribution between groups.

	0-9 M	0-9 F	10-12 M	10-12 F	13+ M	13+ F	TOTAL
16-22	0	0	16	10	10	10	46
23-29	0	0	10	10	29	22	71
30-39	0	0	10	10	11	16	47
40-49	0	0	10	14	10	19	53
50-59	4	7	13	21	11	23	79
60+	16	20	10	19	10	10	85
							381

*Note.*16-22 = Age Group from 16 to 22 years old; 23-29 = Age group from 23 to 29 years old; 30-39 = Age group from 30 to 39 years old; 40-49 = Age group from 40 to 49 years old; 50-59 = Age group from 50 to 59

years old; 60+ = Age group from 60 years oldand over; 0-9 = Education from 0 to 9 years; 10-12 = Education from 10 to 12 years; 13+ = Education from 13 years and over; M = Male; F = Female

3.2 Test of Normality

To decide if parametric statistics could be performed, a test of normality was applied. More specifically, a test of normality was performed for all BVMT-R sub-scores: Trials 1, 2, 3 Total and Delayed Recall score, Learning score, Discrimination Index and Response bias. The Kolmogorov-Smirnov indicated that normality was not assured for any of the sub-scales (all $p < .05$). Table 3 shows the results of the normality test.

Table 3

Normality test results

		Trial1	Trial2	Trial3	Total Recall	Learning	Delayed Recall	Discrimination Index	Response Bias
N		381	381	381	381	381	381	381	381
NormalParameters[a,b]	Mean	5.54	8.25	9.59	23.37	4.17	9.30	5.25	.5365
	SD	3.173	3.426	3.220	9.157	3.024	3.434	1.598	.35738
MostExtreme Differences	Absolute	.092	.168	.263	.152	.123	.245	.363	.365
	Positive	.092	.137	.227	.084	.123	.216	.320	.365
	Negative	-.081	-.168	-.263	-.152	-.082	-.245	-.363	-.339
TestStatistic		.092	.168	.263	.152	.123	.245	.363	.365
p value		.000[c]	.000[c]	.000[c]	.000[c]	.000[c]	.000[c]	.000[c]	.000[c]

a. Test distribution is Normal.

b. Calculatedfromdata.

c. LillieforsSignificanceCorrection.

The results indicate that the assumption underlying the application of the use of parametric statistics was not met. However, because the sample was big enough (381 participants; Field, 2013), parametric statistics could be performed.

3.3 General effect of demographic variables

Multiple linear regression analyses were performed to explore the effect of demographic variable (age, educational level and gender) on BVMT-R performance. The sample was divided into six age groups: 16-22, 23-29, 30-39, 40-49, 50-59 and 60+ years and was further classified into three educational levels: 0-9, 10-12 and 13+ years.

Results of the multiple linear regression analyses indicated that the model explained 48.9% and 48.0% of the variance of the Total and the Delayed Recall score of the BVMT-R respectively and that the model was a significant predictor for both of them (Total Recall $F(3,378)=120,491$; $p<.001$ and Delayed Recall $F(3,378)=116,097$; $p<.001$).

Age, educational level and gender contributed significantly to the model for both Total Recall (Age B= -.275, $p<.001$,95%CI [-.315, -.235]; Educational Level B=.702, $p<.001$,95%CI [.467, .938]; Gender B=2.067,$p=.003$,95%CI [.728, 3.407]) and Delayed Recall (Age B= -.100, $p<.001$,95%CI [-.115, -.085]; Educational Level B=.278, $p<.001$,95%CI [.188, .367]; Gender B=.773, $p=.003$,95%CI [.266, 1.280]).

The model explained 3.7% of the variance of the Learning score of the BVMT-Rand the model was a significant predictor (Learning $F(3,378)=4,836$; $p<.005$). Only educational level contributed significantly to the model for Learning (Educational Level B=.169, $p<.005$,95%CI [.062, .276].

The model explained 14.9% of the variance of the Discrimination Index score of the BVMT-R and the model was a significant predictor ($F(3,378)=22,004$; $p<.001$). Age, educational level and gender contributed significantly to the model for the Discrimination Index score (Age B= -.025, $p<.001$,95%CI [-.034, -.016]; Educational Level B=.072, $p<.01$,95%CI [.019, .125]; Gender B=.379, $p=.014$,95%CI [.077, .680]).

Finally, the model was not a significant predictor for the Response Bias score ($F(3,378)= 1,037$; $p=.376$).

3.4 Effect of Age

A one-way ANOVA was performed to investigate the effect of age on BVMT-R performance between the six age groups. The results revealed a significant effect of age in all BVMT-R scores except for Response Bias ($p=.100$; Table 4). Post-hoc Bonferroni test revealed that in general older participants (age group 60+) performed significantly worse compared to younger participants (age groups 16-22,

23-29, 30-39, 40-49 and 50-59). Regarding only the Learning score, significant differences were revealed only between the 16-22 age group and the 60+ group.

Table 4

F and *p* values for all BVMT-R subscales concerning the effect of Age.

BVMT-R subscales	***F***	***p***
TRIAL 1	32,344	<.001
TRIAL 2	50,009	<.001
TRIAL 3	51,991	<.001
Total Recall	55,470	<.001
Delayed Recall	50,630	<.001
Learning	2,880	.014
Discrimination Index	12,400	<.001
Response Bias	1,862	.100

3.5 Effect of Educational Level

A one-way ANOVA was performed to investigate the effect of educational level on BVMT-R performance between the three educational groups. The results revealed a significant effect of educational level in all BVMT-R scores except for Response Bias (p=.394; Table 5). Post-hoc Bonferroni test revealed significant differences between all educational groups: participants with an educational level of 0-9 years performed significantly worse than participants with 10-12 years and participants with 10-12 years significantly worse than participants with 13+ years. Regarding only the Learning score significant differences were revealed only between the 0-9 education group and the 13+ group.

Table 5

F and *p* values for all BVMT-R subscales concerning the effect of Educational level.

BVMT-R subscales	***F***	***p***
TRIAL 1	36,105	<.001
TRIAL 2	62,829	<.001
TRIAL 3	87,557	<.001
Total Recall	70,392	<.001
Delayed Recall	66,698	<.001
Learning	6,934	.001
Discrimination Index	16,405	<.001
Response Bias	0.935	.394

3.6 Effect of Gender

Finally, a 2-sample t-test was performed to investigate the effect of gender on BVMT-R performance. Results did not revealany statistically significant differences between gender (all $p>.05$)indicatingno gender differences in the performance of BVMT-R for our sample.

4. DISCUSSION

Though the accuracy of neuropsychological tests is confounded by demographic variables(Perkins & Deregowski, 1982), there is still an ongoing debate regarding the necessity to develop norms for every specific population. Those skeptics on the development of such norms are presented with two main arguments: firstly, that developing such norms for every population is rather impractical and secondly that defining populations with certain demographic variables might overcome the identification of critical factors in performance on the tests(Bagley, 1995; Marcopulos & McLain, 2003). In any case neuropsychological instruments are in need to be validated for at least some important measures that have been shown to affect performance such as age, genderand level of education.In the last several years there has been a trend towards the identification of other demographic variables beyond the classical age, education and gender variables(Cherner et al., 2007). In this context and addressing the urgent need for an instrument that could be applied accurately in the Greek population, we conducted the current study.

While the original BVMT-R norms missed the effects of age and education on performance, this has been attributed to the limited range of these variables in this study(Cherner et al., 2007). Our study confirmed the findings of previous studies showing a significant effect of age and level of education on performance(Cherner et al., 2007; Norman et al., 2011;Miotto et al., 2012).While the explanation of the effect of aging on memory tests is rather obviously attributed to the well-known memory decline with advancing age, there is no clear explanation of the effect of years of education on performance. A simple explanation might be that continuous memory training which is interwoven with the process of learning can maintain and even improve memory capabilities.Even gender seems to have been expressed significantly in our regression model, without,though, this being confirmed in further comparison of our 2 groups. Regarding gender, there have been studies suggesting a female

predominance in verbal working memory, while males outperform females in visuospatial memory tasks (Lawton & Hatcher, 2005; Robert & Savoie, 2006).Performance is highly dependent in different studies by the specific tasks under research(Wang & Carr, 2014). In any case we did not identifyany differences between genders in our sample, possibly due to the selected task. Since the regression model examines the three variables concurrently, the dissociation we had between regression models and t-tests could be explained from inherent characteristics of the population with women presenting with fewer years of education, especially in older ages, and a higher life expectancy, thus, the gender variable is expressed as significant in the regression model through discrepancies in the two other variables.

A limitation of the current study, due to certain characteristics of the Greek population,was the difficulty to recruit participants younger than 50 years in the low education groups.A similar remarkregarding the USA population has been mentioned by Cherner et al., (2007). To be more accurate, a request for demographic information was submitted to the Greek National Statistical Service (NSS). According to NSS in this age group the percentage of the population with 0-9 years of education was less than 5% with a trend to decline,thus, these groupswere excluded.Based on the obligatory national education system in Greece the trend is towards the diminution of such subgroups. Even more, a large part of such population, discontinues education due to health issues or due to cultural habits (certain minorities e.g. the Roma population) making them unsuitable for the development of norms of a healthy population by definition.

While the development of age and education specific norms for BVMT-R might confront a need for the assessment of patients in the Greek population, there is still a lot of work to be done in the field of cross-cultural neuropsychology. The current study contributed towards this trend and needs to be reinforced by future studies that will attempt to shed lighton the role of other parameters such as culture and ethnicity, supplemented by comparison clinical studies with unhealthy populations that will implement the new findings.Future studies will hopefully lead to the development of refined neuropsychological instruments with high specificity and sensitivity.

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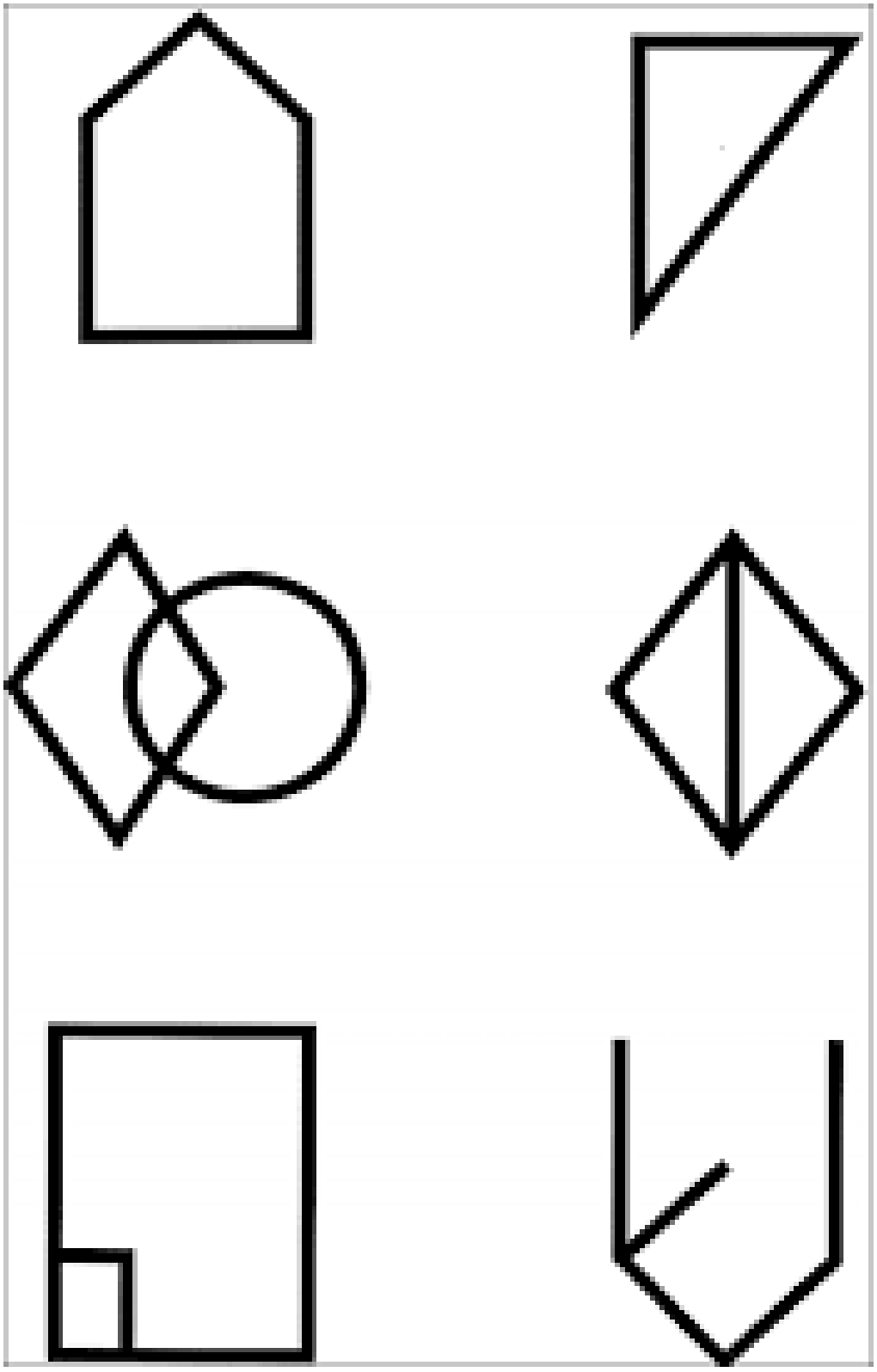
APPENDIX A. ADMINISTERED MATRIX OF SIX GEOMETRIC DESIGNS



APPENDIX B. INFORMATIONLETTER

Εθνικό και Καποδιστριακό Πανεπιστήμιο Αθηνών

Ιατρική Σχολή, Α' Νευρολογική Κλινική

Διευθυντής Καθηγητής Λεωνίδας Στεφανής

Έντυπο πληροφόρησης

ΣΤΑΘΜΙΣΗ ΝΕΥΡΟΨΥΧΟΛΟΓΙΚΩΝ ΔΟΚΙΜΑΣΙΩΝ

Σας ενημερώνουμε ότι εκπαιδευμένοι ψυχολόγοι χορηγούν νευροψυχολογικές δοκιμασίες (Visual Search and Attention Test, Tower of London, Symbol Digit Modalities Brief Visuospatial Test, Wisconsin Card Sorting Test και άλλες), για να σταθμιστούν σε αντιπροσωπευτικό δείγμα του ελληνικού πληθυσμού ώστε στην κλινική πράξη οι μετρήσεις των δοκιμασιών να είναι έγκυρες και αξιόπιστες.

Κάθε άνθρωπος έχει γενετικά χαρακτηριστικά που τον καθιστούνμοναδικό. Ωστόσο, μοιράζεται με τους συνανθρώπους του κοινάδημογραφικά στοιχεία (φύλο, ηλικία, μορφωτικό επίπεδο) και ταίδια χαρακτηριστικά μιας ομάδας που διαβιεί στο ίδιο περιβάλλονκαι μοιράζεται κοινά πολιτιστικά δρώμενα, κοινωνικά γεγονότακαι οικονομικές συνθήκες, που εύκολα τον εντάσσουν σε διακριτόπλαίσιο ομάδας αναφοράς και έτσι μας επιτρέπεται στατιστικά νασυγκρίνουμε τα χαρακτηριστικά των διαφόρων ομάδων με τις οποίες αλληλεπιδρά ταυτίζεται, προσδιορίζεται και αναγνωρίζεται.Η διερεύνηση και εκτίμηση των μεταβλητών της ανθρώπινηςσυμπεριφοράς και γενικότερα των ανωτέρων νοητικώνλειτουργιών για ερευνητικούς ή και κλινικούς λόγους στηρίζεταισε ψυχομετρικές στατιστικές μεθόδους και σε σταθμισμένεςδοκιμασίες ώστε οι μετρήσεις να είναι έγκυρες και αξιόπιστες.

Οι νευροψυχολογικές δοκιμασίες κατασκευάζονται και σταθμίζονται για να ελέγχουν συγκεκριμένες ικανότητες καιδεξιότητες και είναι αντιδεοντολογικό να χρησιμοποιούνται γιαάλλους λόγους ή να χορηγούνται ατύπως και από ανεκπαίδευτοπρόσωπο σε διαφορετικό πολιτισμικό και γλωσσικό πλαίσιο μεσκοπό τη διάγνωση και αξιολόγηση ανθρώπων. Στις περιπτώσειςαυτές ελλοχεύει ο κίνδυνος από τις αναξιόπιστες μετρήσεις ναεξάγονται λανθασμένα συμπεράσματα.

Στο πλαίσιο της έρευνας θα χορηγηθούν οι προς στάθμισηαναφερόμενες δοκιμασίες σε εθελοντές ενήλικες άνω των 16 ετώνμε στοιχειώδη, μέση, ανώτερη και ανώτατη εκπαίδευση, μεμητρική γλώσσα την Ελληνική. Στην συνέχεια, με στατιστικήεπεξεργασία των μετρήσεων θα υπολογιστούν για κάθεαντιπροσωπευτική ομάδα με βάση την ηλικία, το φύλο και τομορφωτικό επίπεδο οι φυσιολογικές τιμές (νόρμες) μέσος όρος,τυπική απόκλιση και εύρος φυσιολογικών τιμών.

Η διαδικασία χορήγησης δεν είναι επεμβατική, έχει μικρήδιάρκεια, δεν κουράζει, δεν απαιτεί ιδιαίτερη προσπάθεια καιγενικότερα το υλικό των δοκιμασιών είναι ακίνδυνο για τησωματική ακεραιότητα ή την ψυχολογική υγεία τωνσυμμετεχόντων. Η χορήγηση των δοκιμασιών θα πραγματοποιηθεί από εκπαιδευμένους ψυχολόγους και νευροψυχολόγους, ειδικά εκπαιδευμένους για τον συγκεκριμένο σκοπό, υπό την εποπτεία του υπεύθυνου για την έρευνα, Καθηγητή, κυρίου Ιωάννη Ζαλώνη.

Όλα τα προσωπικά στοιχεία είναι ανώνυμα και προστατεύονται από τον νόμο:

«Ο Ψυχολόγος στην άσκηση του επαγγέλματός του ερευνά και αξιολογείτην προσωπικότητα και την συμπεριφορά του ανθρώπου και εργάζεται μετις καθιερωμένες αρχές και μεθόδους της Επιστήμης της Ψυχολογίας γιατην αξιοποίηση και βελτίωσή τους... Ο Ψυχολόγος πρέπει να τηρεί απόλυτηεχεμύθεια για όσα μαθαίνει, ή αντιλαμβάνεται κατά την άσκηση τουεπαγγέλματός του.», [Νόμος: 991/1979 (ΦΕΚ 278/τ. Α΄/20-12-1979)].

Υπεύθυνος έρευνας

Ιωάννης Ζαλώνης

Αναπληρωτής Καθηγητής Ιατρικής Σχολής ΕΚΠΑ,
Ά Νευρολογική Κλινική, Νευροψυχολογικό Εργαστήριο
Αιγινήτειο Νοσοκομείο
Βασ. Σοφίας 74- ΤΚ 115 28, Αθήνα
Τηλ.: 210-7289141, Email: zalonis@eginitio.uoa.gr

APPENDIX C. CONSENTFORM

Έντυπο Συναίνεσης

Ο/Η κάτωθι υπογεγραμμένος/η ……..…….δηλώνω ότι ενημερώθηκα διεξοδικά για τη συμμετοχή μου στη μελέτη της στάθμισης Νευροψυχολογικών δοκιμασιών που εκπονείται από το Νευροψυχολογικό Εργαστήριο του Αιγινητείου Νοσοκομείου, και μού δόθηκε η δυνατότητα να θέσω ερωτήματα τα οποίααπαντήθηκαν ικανοποιητικά.

Δίνω τη συγκατάθεσή μου, ώστε τα δεδομένα από τη συμμετοχή μου να αρχειοθετηθούν, να αναλυθούν μέσω στατιστικής επεξεργασίας και να δημοσιευθούν ανώνυμα. Τα δεδομένα αυτά δεθα είναι ονομαστικά και δε θα περιέχουν κάποια άλλη πληροφορία που να αποκαλύπτει τηνταυτότητά μου. Τα ανώνυμα αυτά δεδομένα μπορεί να χρησιμοποιηθούν στο μέλλον για μελέτεςεγκεκριμένες από την Επιτροπή Δεοντολογίας.

Κατανοώ ότι η συμμετοχή μου είναι εθελοντική και διατηρώ το δικαίωμα μου να αποχωρήσω απότην παρούσα μελέτη οποιαδήποτε στιγμή, χωρίς αιτιολόγηση και χωρίς αυτό να επηρεάσει μεοιοδήποτε τρόπο την ιατρική μου περίθαλψη ή τα δικαιώματά μου.

Ημερομηνία:

Όνομα και Επώνυμο συμμετέχοντα:Όνομα και Επώνυμο ερευνητή:

ΥπογραφήΥπογραφή

APPENDIX D. NORMS OF BVMT-R FOR THE GREEK POPULATION

BVMT TRIAL 1

EDUCATIONAL LEVEL (in years)														
	0 to 9					10 to 12					13+			
	n	*M*	*SD*	*MIN*	*MAX*	*n*	*M*	*SD*	*MIN*	*MAX*	*n*	*M*	*SD*	*MIN*
AGE GROUP														
16-22						**26**	**8,23**	**1,91**	**4**	**12**	**20**	**7,95**	**2,46**	**4**
Male						16	7,94	1,85	4	11	10	8,90	2,43	5
Female						10	8,70	1,90	6	12	10	7,00	2,10	4
23-29						**20**	**6,70**	**2,03**	**3**	**11**	**51**	**6,24**	**2,89**	**0**
Male						10	7,40	1,43	5	10	29	5,41	2,54	0
Female						10	6,00	2,28	3	11	22	7,32	2,98	2
30-39						**20**	**7,10**	**2,96**	**0**	**11**	**27**	**7,04**	**2,82**	**3**
Male						10	7,40	3,38	0	11	11	8,73	2,86	3
Female						10	6,80	2,44	3	11	16	5,88	2,12	3
40-49						**24**	**5,92**	**3,07**	**1**	**12**	**29**	**6,00**	**2,70**	**1**
Male						10	4,90	3,01	1	9	10	6,00	3,35	1
Female						14	6,64	2,89	2	12	19	6,00	2,29	2
50-59	**11**	**4,45**	**2,81**	**0**	**9**	**34**	**4,47**	**2,34**	**0**	**11**	**34**	**6,09**	**2,69**	**2**
Male	4	2,50	3,28	0	8	13	3,85	2,35	0	7	11	6,73	2,96	2
Female	7	5,57	1,68	3	9	21	4,86	2,25	0	11	23	5,78	2,50	2
60+	**36**	**1,56**	**2,07**	**0**	**7**	**29**	**3,00**	**2,20**	**0**	**7**	**21**	**4,43**	**2,65**	**1**
Male	16	1,06	1,30	0	4	10	2,10	1,58	0	4	11	4,00	2,30	1
Female	20	1,95	2,46	0	7	19	3,47	2,33	0	7	10	4,90	2,91	1

BVMT TRIAL 2

EDUCATIONAL LEVEL (in years)															
	0 to 9					10 to 12					13+				
	n	*M*	*SD*	*MIN*	*MAX*	*n*	*M*	*SD*	*MIN*	*MAX*	*N*	*M*	*SD*	*MIN*	*MAX*
AGE GROUP															
16-22						**26**	**10,65**	**1,41**	**8**	**12**	**20**	**11,10**	**1,26**	**8**	**12**
Male						16	10,56	1,37	8	12	10	11,50	1,02	9	12
Female						10	10,80	1,47	8	12	10	10,70	1,35	8	12
23-29						**20**	**9,50**	**1,80**	**4**	**12**	**51**	**9,92**	**1,90**	**6**	**12**
Male						10	10,00	1,18	7	12	29	9,69	1,91	6	12
Female						10	9,00	2,14	4	12	22	10,23	1,83	6	12
30-39						**20**	**9,95**	**2,62**	**1**	**12**	**27**	**9,81**	**2,45**	**3**	**12**
Male						10	9,80	3,40	1	12	11	10,64	1,82	6	12
Female						10	10,10	1,45	8	12	16	9,25	2,66	3	12
40-49						**24**	**8,79**	**2,53**	**3**	**12**	**29**	**8,86**	**2,58**	**3**	**12**
Male						10	8,40	2,65	3	12	10	8,80	2,64	5	12
Female						14	9,07	2,40	5	12	19	8,89	2,55	3	12
50-59	**11**	**6,91**	**2,15**	**5**	**11**	**34**	**7,24**	**3,03**	**0**	**12**	**34**	**9,09**	**2,63**	**2**	**12**
Male	4	6,75	2,49	5	11	13	6,46	2,95	2	11	11	8,73	3,19	2	12
Female	7	7,00	1,93	5	10	21	7,71	2,98	0	12	23	9,26	2,29	2	12
60+	**36**	**2,94**	**2,92**	**0**	**11**	**29**	**5,14**	**3,18**	**0**	**12**	**21**	**6,62**	**3,36**	**2**	**12**
Male	16	1,69	1,89	0	7	10	3,50	2,16	1	8	11	5,73	3,19	2	11

Female	20	3,95	3,20	0	11	19	6,00	3,29	0	12	10	7,60	3,26	3	12

BVMT TRIAL 3														
EDUCATIONAL LEVEL (in years)														
	0 to 9					**10 to 12**					**13+**			
	n	***M***	***SD***	***MIN***	***MAX***	***n***	***M***	***SD***	***MIN***	***MAX***	***n***	***M***	***SD***	***MIN***
AGE GROUP														
16-22						**26**	**11,31**	**1,29**	**8**	**12**	**20**	**11,80**	**0,40**	**11**
Male						16	10,88	1,49	8	12	10	11,90	0,30	11
Female						10	12,00	0,00	12	12	10	11,70	0,46	11
23-29						**20**	**10,95**	**1,12**	**8**	**12**	**51**	**11,31**	**1,16**	**8**
Male						10	10,90	1,14	8	12	29	11,21	1,30	8
Female						10	11,00	1,10	9	12	22	11,45	0,94	8
30-39						**20**	**10,80**	**2,06**	**3**	**12**	**27**	**11,44**	**0,99**	**8**
Male						10	10,40	2,76	3	12	11	11,73	0,45	11
Female						10	11,20	0,75	10	12	16	11,25	1,20	8
40-49						**24**	**10,42**	**1,98**	**4**	**12**	**29**	**10,28**	**1,95**	**4**
Male						10	9,60	2,33	4	12	10	9,90	2,17	6
Female						14	11,00	1,41	7	12	19	10,47	1,79	4
50-59	**11**	**8,55**	**2,39**	**5**	**12**	**34**	**8,82**	**2,98**	**1**	**12**	**34**	**10,44**	**2,25**	**3**
Male	4	7,50	2,87	5	12	13	8,54	3,05	4	12	11	10,00	2,73	5
Female	7	9,14	1,81	7	12	21	9,00	2,93	1	12	23	10,65	1,95	3
60+	**36**	**3,86**	**3,58**	**0**	**12**	**29**	**6,83**	**3,17**	**0**	**12**	**21**	**8,52**	**3,13**	**3**
Male	16	2,69	2,66	0	9	10	6,10	2,21	3	9	11	7,91	3,63	3
Female	20	4,80	3,92	0	12	19	7,21	3,52	0	12	10	9,20	2,27	5

BVMT TOTAL RECALL															
EDUCATIONAL LEVEL (in years)															
	0 to 9					**10 to 12**					**13+**				
	n	***M***	***SD***	***MIN***	***MAX***	***N***	***M***	***SD***	***MIN***	***MAX***	***n***	***M***	***SD***	***MIN***	***MAX***
AGE GROUP															
16-22						**26**	**30,19**	**3,76**	**20**	**36**	**20**	**30,85**	**3,31**	**24**	**36**
Male						16	29,38	3,84	20	35	10	32,30	3,26	27	36
Female						10	31,50	3,23	26	36	10	29,40	2,65	24	33
23-29						**20**	**27,15**	**3,99**	**18**	**35**	**51**	**27,47**	**5,14**	**16**	**36**
Male						10	28,30	2,45	23	32	29	26,31	4,91	16	34
Female						10	26,00	4,82	18	35	22	29,00	5,04	16	36
30-39						**20**	**27,85**	**7,14**	**4**	**35**	**27**	**28,30**	**5,68**	**15**	**36**
Male						10	27,60	9,29	4	35	11	31,09	4,94	20	36
Female						10	28,10	3,96	22	35	16	26,38	5,34	15	36
40-49						**24**	**25,13**	**6,90**	**8**	**36**	**29**	**25,14**	**6,56**	**9**	**35**
Male						10	22,90	7,31	8	32	10	24,70	7,82	12	35
Female						14	26,71	6,11	14	36	19	25,37	5,78	9	34
50-59	**11**	**20,18**	**7,32**	**10**	**33**	**34**	**20,53**	**7,59**	**1**	**35**	**34**	**25,62**	**6,86**	**7**	**34**
Male	4	16,75	8,58	10	31	13	18,85	7,30	7	29	11	25,45	8,40	10	33
Female	7	22,14	5,62	17	33	21	21,57	7,58	1	35	23	25,70	5,99	7	34

60+	**36**	**8,36**	**7,77**	**0**	**29**	**29**	**14,69**	**7,69**	**1**	**29**	**21**	**19,57**	**8,52**	**6**	**35**
Male	16	5,44	5,05	0	19	10	11,80	5,53	5	22	11	17,64	8,56	6	31
Female	20	10,70	8,72	0	29	19	16,21	8,21	1	29	10	21,70	7,94	10	35

BVMT LEARNING

EDUCATIONAL LEVEL (in years)

	0 to 9					**10 to 12**					**13+**				
	n	***M***	***SD***	***MIN***	***MAX***	***N***	***M***	***SD***	***MIN***	***MAX***	***n***	***M***	***SD***	***MIN***	***MAX***
AGE GROUP															
16-22						**26**	**3,54**	**1,69**	**0**	**6**	**20**	**3,95**	**2,73**	**0**	**10**
Male						16	3,69	1,53	1	6	10	3,60	3,17	0	10
Female						10	3,30	1,90	0	6	10	4,30	2,15	0	8
23-29						**20**	**4,25**	**2,19**	**0**	**7**	**51**	**5,14**	**2,61**	**0**	**12**
Male						10	3,50	2,06	0	6	29	5,93	2,43	2	12
Female						10	5,00	2,05	1	7	22	4,09	2,47	0	9
30-39						**20**	**3,70**	**2,19**	**1**	**9**	**27**	**4,48**	**2,47**	**0**	**8**
Male						10	3,00	1,55	1	5	11	3,00	2,52	0	8
Female						10	4,40	2,50	1	9	16	5,50	1,84	0	8
40-49						**24**	**4,42**	**2,23**	**0**	**9**	**29**	**4,17**	**2,05**	**0**	**8**
Male						10	4,70	2,45	1	9	10	3,90	1,97	1	8
Female						14	4,21	2,04	0	8	19	4,32	2,08	0	7
50-59	**11**	**4,00**	**1,54**	**2**	**6**	**34**	**4,26**	**2,43**	**-2**	**10**	**34**	**5,26**	**6,47**	**0**	**40**
Male	4	4,75	1,09	3	6	13	4,77	2,78	-1	10	11	6,55	10,74	1	40
Female	7	3,57	1,59	2	6	21	3,95	2,13	-2	7	23	4,65	2,35	0	9
60+	**36**	**2,56**	**2,65**	**-1**	**12**	**29**	**3,76**	**1,77**	**0**	**7**	**21**	**4,00**	**2,31**	**0**	**10**
Male	16	1,81	2,04	-1	6	10	3,60	1,91	0	6	11	3,91	2,61	0	10
Female	20	3,15	2,92	0	12	19	3,84	1,69	1	7	10	4,10	1,92	1	7

BVMT DELAY RECALL															
EDUCATIONAL LEVEL (in years)															
	0 to 9					10 to 12					13+				
	n	*M*	*SD*	*MIN*	*MAX*	*n*	*M*	*SD*	*MIN*	*MAX*	*n*	*M*	*SD*	*MIN*	
AGE GROUP															
16-22						**26**	**11,15**	**1,20**	**8**	**12**	**20**	**11,65**	**0,65**	**10**	
Male						16	10,75	1,35	8	12	10	11,90	0,30	11	
Female						10	11,80	0,40	11	12	10	11,40	0,80	10	
23-29						**20**	**10,90**	**1,26**	**7**	**12**	**51**	**11,27**	**1,24**	**7**	
Male						10	10,80	1,08	9	12	29	11,28	1,34	7	
Female						10	11,00	1,41	7	12	22	11,27	1,09	8	
30-39						**20**	**10,45**	**2,71**	**0**	**12**	**27**	**11,15**	**1,30**	**8**	
Male						10	10,00	3,66	0	12	11	11,18	1,27	8	
Female						10	10,90	0,94	9	12	16	11,13	1,32	8	
40-49						**24**	**10,04**	**2,46**	**2**	**12**	**29**	**9,66**	**2,66**	**2**	
Male						10	9,90	2,34	4	12	10	9,60	2,11	6	
Female						14	10,14	2,53	2	12	19	9,68	2,90	2	
50-59	**11**	**8,73**	**2,53**	**5**	**12**	**34**	**8,32**	**3,14**	**0**	**12**	**34**	**10,35**	**1,97**	**3**	
Male	4	7,75	2,95	5	12	13	7,92	3,38	0	12	11	9,91	1,78	7	
Female	7	9,29	2,05	7	12	21	8,57	2,95	1	12	23	10,57	2,02	3	
60+	**36**	**3,69**	**3,67**	**0**	**12**	**29**	**6,10**	**3,69**	**0**	**12**	**21**	**7,81**	**3,42**	**2**	
Male	16	2,56	2,83	0	9	10	5,30	3,49	0	9	11	7,36	3,44	3	
Female	20	4,60	3,99	0	12	19	6,53	3,72	0	12	10	8,30	3,32	2	

BVMT DISCRIMINATION INDEX															
EDUCATIONAL LEVEL (in years)															
	0 to 9					10 to 12					13+				
	n	*M*	*SD*	*MIN*	*MAX*	*n*	*M*	*SD*	*MIN*	*MAX*	*n*	*M*	*SD*	*MIN*	*MAX*
AGE GROUP															
16-22						**26**	**5,92**	**0,27**	**5**	**6**	**20**	**5,95**	**0,22**	**5**	**6**
Male						16	5,88	0,33	5	6	10	6,00	0,00	6	6
Female						10	6,00	0,00	6	6	10	5,90	0,30	5	6
23-29						**20**	**5,95**	**0,22**	**5**	**6**	**51**	**5,57**	**1,29**	**0**	**6**
Male						10	5,90	0,30	5	6	29	5,48	1,30	1	6
Female						10	6,00	0,00	6	6	22	5,68	1,26	0	6
30-39						**20**	**5,45**	**1,96**	**-3**	**6**	**27**	**5,63**	**1,36**	**-1**	**6**
Male						10	5,00	2,68	-3	6	11	5,36	2,01	-1	6
Female						10	5,90	0,30	5	6	16	5,81	0,53	4	6
40-49						**24**	**5,71**	**0,61**	**4**	**6**	**29**	**5,34**	**1,65**	**-3**	**6**
Male						10	5,60	0,66	4	6	10	5,70	0,46	5	6
Female						14	5,79	0,56	4	6	19	5,16	1,98	-3	6
50-59	**11**	**4,73**	**1,48**	**2**	**6**	**34**	**5,15**	**1,80**	**-3**	**6**	**34**	**5,59**	**0,81**	**2**	**6**
Male	4	3,75	1,79	2	6	13	5,00	2,39	-3	6	11	5,55	0,50	5	6
Female	7	5,29	0,88	4	6	21	5,24	1,31	0	6	23	5,61	0,92	2	6
60+	**36**	**3,86**	**1,93**	**0**	**6**	**29**	**4,28**	**1,91**	**-1**	**6**	**21**	**4,67**	**2,34**	**-1**	**6**
Male	16	3,81	1,70	1	6	10	3,80	1,66	-1	5	11	3,64	2,80	-1	6
Female	20	3,90	2,10	0	6	19	4,53	1,98	0	6	10	5,80	0,60	4	6

BVMT RESPONSE BIAS															
EDUCATIONAL LEVEL (in years)															
	0 to 9					10 to 12					13+				
	n	*M*	*SD*	*MIN*	*MAX*	*n*	*M*	*SD*	*MIN*	*MAX*	*n*	*M*	*SD*	*MIN*	*MAX*
AGE GROUP															
16-22						**26**	**0,51**	**0,10**	**0,3**	**0,75**	**20**	**0,49**	**0,05**	**0,25**	**0,5**
Male						16	0,55	0,10	0,5	0,75	10	0,50	0,00	0,5	0,5
Female						10	0,46	0,08	0,3	0,5	10	0,48	0,08	0,25	0,5
23-29						**20**	**0,50**	**0,00**	**0,5**	**0,5**	**51**	**0,49**	**0,12**	**0,08**	**0,93**
Male						10	0,50	0,00	0,5	0,5	29	0,47	0,12	0,08	0,8
Female						10	0,50	0,00	0,5	0,5	22	0,51	0,11	0,25	0,93
30-39						**20**	**0,51**	**0,09**	**0,25**	**0,75**	**27**	**0,50**	**0,08**	**0,25**	**0,81**
Male						10	0,54	0,08	0,5	0,75	11	0,53	0,09	0,5	0,81
Female						10	0,48	0,08	0,25	0,5	16	0,48	0,06	0,25	0,5
40-49						**24**	**0,55**	**0,14**	**0,25**	**0,93**	**29**	**0,52**	**0,14**	**0,25**	**0,75**
Male						10	0,53	0,13	0,25	0,75	10	0,58	0,11	0,5	0,75
Female						14	0,57	0,14	0,5	0,93	19	0,49	0,15	0,25	0,75
50-59	**11**	**0,55**	**0,21**	**0,25**	**0,9**	**34**	**0,55**	**0,18**	**0,17**	**0,93**	**34**	**0,45**	**0,16**	**0,1**	**0,93**
Male	4	0,76	0,16	0,5	0,9	13	0,49	0,14	0,17	0,75	11	0,41	0,12	0,25	0,5
Female	7	0,43	0,11	0,25	0,5	21	0,59	0,19	0,25	0,93	23	0,48	0,17	0,1	0,93
60+	**36**	**0,52**	**0,23**	**0**	**0,9**	**29**	**0,58**	**0,20**	**0,17**	**0,88**	**21**	**0,49**	**0,14**	**0,17**	**0,5**
Male	16	0,52	0,20	0,17	0,83	10	0,57	0,22	0,17	0,83	11	0,51	0,16	0,25	0,83
Female	20	0,53	0,26	0	0,9	19	0,58	0,18	0,17	0,88	10	0,46	0,10	0,17	0,5