

## Correlation of phoria with personality: A pioneering study

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### Abstract

The development of concomitant squint is a function of personality trait of a child. It is also a known fact that the personality trait of a child is carried forward to his adult personality. Therefore a hypothesis that phoria is correlated with personality was postulated. The objective of the study is to examine how exophoria is correlated with neuroticism- Stable and Extravert- Introvert dimensions of personality. After taking proper informed consent, fifty-eight undergraduate and postgraduate medical students with atleast -2.00 D spherical equivalent myopia were evaluated in a tertiary eye hospital in West Bengal for their Personality on Neuroticism (N) and Extraversion (E) scales by Maudsley Personality Inventory (MPI) 48 questionnaires. Maximum and minimum possible scores on each scale was 48.00 and 0.00 respectively. Their Phoria status (hetrophoria/ orthophoria) was also evaluated. Out of a total of fifty eight (58), thirty two (32) students were male and twenty six (26) were female. The age range of the 58 students was 18-30 years (24.53 +/- 3.45). 37 (thirty-seven, 63.79%) of them had exophoria and the rest 21 (twenty-one, 36.20%) had orthophoria. Mean, Standard Deviation of the scores on Neuroticism (N) and Extraversion (E) scale for 58 students were 23.82 +/- 8.45 and 23.06 +/- 8.78 respectively. The students were grouped into two, one with 'Phoria' (n=37) and other with 'No Phoria' (orthophoria, n=21) and were compared with two outcomes, N-scores  $\leq$  24 (stable personality tendency, n=37) and N- scores  $>$  24 (neurotic personality tendency, n= 21) by Fisher Exact Test. The test showed exophorias were correlated with stable personality pattern (P =0.0005). However phoria was not found to be correlated with Extraversion-Introversion dimension of personality (P = 0.2836). Exophorias correlated with stable personality pattern, a fact, which to authors' belief, is probably discovered for the first time by this study.

**Keywords:** Phoria, Exophoria, Orthophoria, Maudsley Personality Inventory(MPI), Personality, Neuroticism-Stable, Extraversion-Introversion.

### Introduction

Personality of a child plays an important role in the development of concomitant squint. The role of personality of a child in the development of convergent concomitant squint in an uncorrected hypermetrope was described by Von Noorden as follows: "Whether the visual system reacts with esotropia and clear vision versus orthophoria and blurred vision depends less on the degree of hypermetropia than on a child's personality".<sup>(1)</sup> He exemplified how two siblings, an 8-year old girl and her 6-year old brother both having same magnitude of hypermetropia reacted differently in a conflict situation to choose between esotropia and clear vision versus orthophoria and blurred vision. The boy preferred to relax accommodation and see blur but remained orthophoric. Conversely the girl instinctively exerted excessive accommodation and sees clear but squinted inwards. Similarly in uncorrected myopia constant under-stimulation of convergence for near vision leads to dilemma between clear vision and squinting outwards versus blur vision and orthophoria to which a child instinctively respond according to his personality trait.<sup>(2)</sup>

Jones<sup>(3)</sup> defined Neuroticism as vulnerability to neurosis which implies low tolerance for stress whether it be physical as in painful situations, or psychological as in conflict or 'frustration' situations. Therefore as per Jones's definition the boy and the girl in the example above, though having same magnitude of refractive

error reacted differently in a psychological conflict situation according to their personality in Neuroticism-Stable<sup>(4)</sup> dimension of personality. Therefore it is evident that the development of squint is a function of child's personality trait. There are ample evidence also that a child's personality trait is carried forward to his adult life personality.<sup>(5)</sup>

Therefore the presence or absence of phoria (latent squint)/ tropia (manifest squint) in an adult may be indicative of his personality pattern. As phoria is a preponderant entity than tropia, phoria rather than tropia was adopted for this research study. A myopic student population was selected as sample for the study. It can be safely presumed that these students in their childhood faced the psychological conflict situation as described above and ended up with either "exophoria" or "no phoria" according to their personality trait. Therefore, we would find out how "exophoria" and "no phoria" (orthophoria) would be correlated with Neuroticism- Stable and Extravert- Introvert dimensions of their personality.

In this study personality was considered as a cause of phoria, and not an effect of it. Therefore this study of correlating phoria with personality is unique and pioneering as, to the best of our knowledge, no study on this correlation was undertaken before.

## Materials and Method

The study was conducted in a tertiary eye care centre in West Bengal. Clearance from Institutional Ethics Committee was obtained. Prior informed consent was taken from all the participants. Fifty-eight myopic ( $\geq -2.00$  Dioptre Spherical equivalent refractive error) students studying MBBS or DO/MS were included in the study. Inclusion criteria were best corrected distant visual acuity 6/6 or better in each eye at 6.0 m and best corrected near acuity N/6 at 32 cm, absence of manifest strabismus at 6.0 m and 32 cm with cover test, no history of eye or head trauma and normal ocular health. Pure astigmatic error and compound error with astigmatism  $> -1.00$  DCyl was excluded from the study. Brief history comprising of age, sex, religion, educational background, spectacle use were noted. Each student's visual acuity and refractive error was recorded. All students included in this study were required to write the University examination in English language and hence their comprehension in English language was assured. The personality of the students were determined on two dimensions namely Neuroticism (N) and Extraversion (E) by Maudsley Personality Inventory (MPI) questionnaires.<sup>(4)</sup> Each student was given the questionnaire comprising of forty-eight questions, twenty four each on Neuroticism (N) and Extraversion (E) scales from the MPI, Original English version.<sup>(4)</sup> Original MPI Questionnaire in English language was used for the study as no validated MPI in Bengali language was available in literature. However the meaning of certain difficult English words like 'ponder over' (question 3), 'high strung' (question 10), 'disgruntled' (question 22), 'over conscientious' (question 27), 'hilariously' (question 38), 'pranks' (question 47) were explained to the participants at the beginning of the test session. The students were asked

to answer to each question in one of the three: "Yes", "No", "?". At the end of answering to the questionnaire, each student was examined for the presence of horizontal phoria (latent squint) at distance (six metres) and at near (32 cm), by means of Prism Bar Cover Test (PBCT), with meticulous precision as described by Von Noorden.<sup>(6)</sup> Those with near exophoria greater than distance phoria by 6 prism dioptre or more was considered as presence of phoria. Those with physiological exophoria ( $<6$  pd difference between distance and near fixation) was included in orthophoria.

**Scoring of Neuroticism (N) and Extraversion (E):** The scoring of the two questionnaires as per MPI protocol was as follows: Any "Yes" answer on the neuroticism scale was counted two points; any "No" answer was counted zero point; any "?" was counted one point. On the extraversion scale, answers in conformity with the key were scored two points; answers contrary to the key were scored zero points; "?" answers were score done point. The highest and lowest possible score on either scale was therefore 48 and 0 respectively.

## Results

Out of a total of fifty eight (58), thirty two (32) students were male and twenty six (26) were female. The age range of all (male + female) students was 18-30 years (24.53  $\pm$  3.45). Students were found to have Spherical equivalent myopia ranging from  $-2.00$  D to  $-12.00$  D. Out of total 58 (Fifty eight) students, 37 (thirty seven, 63.79%) had exophorias and the rest 21 (twenty one, 36.20%) had orthophoria. Data relating to Age, Gender, and Myopia were tabulated in Table 1. Frequency distribution of exophoria of the students were shown in Table 2.

**Table 1: Data relating to Age, Gender and Myopia and their statistical difference between exophoric and orthophoric groups**

Age (years)	Total Sample (n=58)		Exophoria Group (n=37)		Orthophoria Group (n=21)		P Value
	Range	Mean $\pm$ SD	Mean $\pm$ SD		Mean $\pm$ SD		
	18-30	24.53 $\pm$ 3.45	24.56 $\pm$ 3.32		24.47 $\pm$ 3.74		0.9248 (NS)
Spherical equivalent Myopia	-2.00 D to -12.00 D	RE: -3.44 $\pm$ 1.66 LE: -3.38 $\pm$ 1.91	RE: -3.51 $\pm$ 1.93 LE: -2.92 $\pm$ 2.87		RE: -3.33 $\pm$ 1.06 LE: -2.97 $\pm$ 1.87		0.6951 (NS) 0.9432 (NS)
Gender	Total Sample (n=58)		Exophoria Group (n=37)		Orthophoria Group (n=21)		P Value
	Male n (%)	Female n (%)	Male n (%)	Female n (%)	Male n (%)	Female n (%)	
	32 (55.17)	26 (44.82)	19 (51.35)	18 (48.64)	13 (61.90)	8 (38.09)	

NS= Not statistically significant

**Table 2: Frequency distribution of exophoria and orthophoria in the present study sample**

Exophoria at near		Orthophoria both at distance and near(n)
>/= 6 pdthan distance(n)	< 6 pd than distance(n) (Physiological exophoria)	
37	7	14

The scores on Neuroticism (N) and Extraversion (E) scales of male, female and Mixed (male and female) students were given in Table 3.

**Table 3: Mean, Standard Deviation of the Neuroticism (N), Extraversion (E) Scales of the MPI for the present study**

Sex	Number	N scale			E scale		
		Mean	SD	P-value	Mean	SD	P-value
Male myopic	32	25.34	9.45	0.1310 (NS)	21.59	9.67	0.1574(NS)
Female myopic	26	21.96	6.75		24.88	7.31	
Mixed (Male + Female)myopic	58	23.82	8.45	0.8972(NS)	23.06	8.78	0.1919(NS)

NS=Statistically not Significant

In Table 4, N and E scale scores of students of the present study were compared with that of English and American students.

**Table 4: Mean, Standard Deviation of the Neuroticism(N), Extraversion(E) Scales of the MPI for English and American students compared (P-values) with the present study**

	Sample(n)	N scale		P value	E scale		P value,
		Mean	SD		Mean	SD	
English university students. Mixed <sup>(7)</sup>	64			0.0689 NS			0.2282 NS
		26.78	9.28		25.16	10.22	
American university students.Mixed <sup>7</sup>	145	21.57	9.75	0.1250 NS	27.77	7.60	0.0002, SS
Present study. Mixed	58	23.82	8.45		23.06	8.78	

NS= Statistically Not significant. SS= Statistically Significant

**Statistical Analysis:** The Mean of Neuroticism score of the study sample was 23.82 i.e. approximately 24.00. Moreover 24.00 is the arithmetic mean of the lowest (0.00) and the highest (48.00) scores possible in the Neuroticism scale. Therefore for statistical analysis, students were grouped into two, one with 'Phoria' (exophoria, n=37) and other with 'No Phoria' (orthophoria, n=21) and compared with two outcomes, N-scores  $\leq$  24 (stable personality tendency, n=37) and N- scores  $>$  24 (neurotic personality tendency, n= 21) by Fisher Exact Test 2x2 contingency table (Table 5).

**Table 5: Fisher's exact test comparing two groups, 'Phoria'(exophoria) and 'No Phoria' (orthophoria) and two outcomes, N-scale score  $\leq$  24 (stable personality tendency) and N-scale score  $>$ 24 (neurotic personality tendency) in myopicmedical student population**

	N-scale score $\leq$ 24	N-scale score $>$ 24	Total
'Phoria'	30	7	37
'No phoria'	7	14	21
Total	37	21	58

The two-tailed P value equals 0.0005 (statistically significant)

Similarly, students were grouped into two, one with 'Phoria' (exophoria, n=37) and other with 'No Phoria' (orthophoria, n=21) and compared with two outcomes, E-scores  $\leq$  24 (Introvert personality tendency, n=30) and E- scores  $>$  24 (Extravert personality tendency, n= 28) by Fisher Exact Test 2x2 contingency table (Table 6).

**Table 6: Fisher's exact test comparing two groups, 'Phoria' and 'No Phoria' and two outcomes, E-scale score  $\leq 24$  (Introvert personality tendency) and E-scale score  $>24$  (Extravert personality tendency)**

	E-scale score $\leq 24$	E-scale score $>24$	Total
'Phoria'	17	20	37
'No Phoria'	13	08	21
Total	30	28	58

The two-tailed P value equals 0.2836 (statistically not significant)

## Discussion

Certain biological factors have proven correlation with certain dimension of personality. Eysenck, 1957 postulated that individuals in whom excitatory cortical potential is slow to generate and weak in strength tend to develop extraverted pattern of personality and reverse is true for introverts in whom the generated excitatory potentials are strong and quick.<sup>(8)</sup> Eysenck, 1957 also argued that introverts would condition better than extraverts. Eye blink conditioning test was used by many investigators to this effect and found that when certain conditions were fulfilled, significant difference between introverts and extraverts appear.<sup>(8)</sup> However the correlation of biological factors with Neuroticism was less convincing until some recent advancement. Jensen (1964) found no relationship between higher function learning and Neuroticism.<sup>(8)</sup> Shanmugan and Santhanam found a positive one, and Jensen (1962) found a negative one under stress condition and a mildly positive one under no stress conditions.<sup>(8)</sup> Eysenck (1962) did not find any marked positive or negative correlations between pursuit rotor learning or reminiscence and Neuroticism.<sup>(8)</sup> Recent studies using functional magnetic resonance imaging during individuals engaged in cognitive-affective tasks have shown that individual differences in participants' E and N scores are correlated with individual differences in brain activation in specific brain regions.<sup>(9)</sup> However looking from recently introduced neurogenetic perspective of neuroticism,<sup>(10)</sup> a common neural or genetic attribute to Phoria and Personality cannot be ruled out. In the backdrop of the above discussion, it can be said that correlating phoria with personality in this present study is a unique and pioneering one. However there was a qualitative difference of previous studies on correlation of biological factors with personality and the present study. While previous ones, as discussed above, were about biological attribute to personality, the present one was about personality attribute to biology (Psychosomatic). Maudsley Personality Inventory (MPI) was chosen for this study as it is regarded, from its inception till today, as the preferred measure of extraversion- introversion and neuroticism -stable for research purposes.<sup>(7,11)</sup> MPI 48 Questionnaire (Eysenck, 1956) was used because it is brief, highly reliable, orthogonal for normal population, highly correlated with other measures of the factors, negligibly correlated with non-personality variables like age, sex, and intelligence and correlated with other experimental and non-questionnaire variables of

Eysenck's cortical inhibition theory of introversion-extraversion.<sup>(4)</sup> Nevertheless, the two comparing groups of our study were matching in respect of age, gender and myopia (Table 1). Contrary to popular belief, myopia is not correlated with secondary personality changes.<sup>(12)</sup> The prevalence of personality of students in the present study is in conformity with that of English and American university students (Table 4) excepting American University students were more extraverted than ours (P=0.0002).

From statistical analysis of the results obtained in the study (Table 5) it is seen that 81.08 % of those with 'Phoria' (exophoria) will have a chance of having stable personality pattern compared to 33.33% of orthophoric ('No Phoria') having such chance. This difference is extremely statistically significant (P = 0.0005). Whereas only 18.91% of those with 'Phoria' will have the chance to have neurotic personality pattern, compared to 66.66% of orthophoric ('No Phoria') in this myopic study sample having such chance. (P = 0.0005). Therefore Phorics will have a high tendency to have a stable personality and low tendency for neurotic personality- this was evolved by this study. However phoria showed no correlation with Extraversion - Introversion dimension of personality (P=0.2836, Table 6).

**Explanation of analysed results:** Von Noorden<sup>(1)</sup> exemplified how two siblings, an 8-year old girl and her 6-year old brother both having same magnitude of hypermetropia reacted differently in a conflict situation to choose between esotropia and clear vision versus orthophoria and blurred vision. The boy unable to cope up with asthenopia and diplopia due to high accommodative convergence associated with uncorrected hypermetropia preferred to relax accommodation and see blur but remained orthophoric. Conversely the girl instinctively ignored the stress and exerted excessive accommodation and sees clear but squinted inwards.

Jones (1960)<sup>(3)</sup> defined Neuroticism as vulnerability to neurosis which implies low tolerance for stress whether it be physical as in painful situations, or psychological as in conflict or 'frustration' situations. Therefore as per Jones's definition the boy had low tolerance for stress and thus had neurotic type of personality and should have high score on Neuroticism- Stable scale.<sup>(4)</sup> Whereas the girl had high tolerance for stress as she confronted the stress and therefore had a stable personality character and should be low on Neuroticism- Stable scale.<sup>(4)</sup> In uncorrected

myopia constant under stimulation of convergence even in near vision to see clear leads to dilemma between clear vision and squinting outwards versus blur vision and orthophoria.<sup>(2)</sup> A child with stable personality trait will ignore the stress of diplopia (associated with squinting) to see clear whereas, a child with neurotic personality trait being less tolerant to stress opt to see blur but remain orthophoric.

In the present study, fifty eight students with  $\geq -2$  D myopia were included. Due to uncorrected myopia in their childhood, constant under-stimulation of convergence even in near vision to see clear led to dilemma between clear vision and squinting outwards versus blur vision and orthophoria.<sup>(2)</sup> Those students with stable personality trait ignored the stress of diplopia (associated with squinting) to see clear but squinted, whereas those with neurotic personality trait being less tolerant to stress opted to see blur but remained orthophoric. These phoria status (exophoria/orthophoria) thus acquired by them in their childhood was carried forward to their adult life and was picked up by this study.

### Conclusion

The study showed exophorias are positively correlated with stable personality pattern. However as bottom line for the causation of all concomitant squint is instinctive adoption of squinting and clear vision vis-a-vis orthophoria and blurred vision, we can say heterophorias are positively correlated with stable personality. This revelation may open up the opportunity to evaluate phoria test as an objective test for personality assessment. To the best of our knowledge this correlation is probably discovered for the first time by this present study. However this is a pilot study and a study comprising of very large sample is running in our institute.

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### Reference

1. Von Noorden GK, Campos EC. Esodeviations. In: Von Noorden GK, Campos EC, editors. Binocular vision and ocular motility. Theory and Management of Strabismus. 6<sup>th</sup> edition: St Louis. Mosby, Inc. 2002. pp 314-16.
2. Von Noorden GK, Campos EC. Exodeviations. In: Von Noorden GK, Campos EC, editors. Binocular vision and ocular motility. Theory and Management of Strabismus. 6<sup>th</sup> edition: St Louis. Mosby, Inc. 2002. pp 357.
3. Jones HG. Individual differences in inhibitory potential. Br J Psychol. 1960;51:220-5.
4. Eysenck HJ. The Questionnaire Measurement of Neuroticism and Extraversion. In: Eysenck HJ. editor. Readings in Extraversion-Introversion 1. Theoretical and Methodological Issues. Staples Press. London. 1970. 119-122.
5. Burt C. Factorial studies of personality and their bearing on the work of the teacher. Br J Psychol. 1965;35:368-78.
6. Von Noorden GK, Campos EC. Examination of Patient – II, Motor signs in heterophoria and heterotropia. In: Von Noorden GK, Campos EC, editors. Binocular vision and ocular motility. Theory and Management of Strabismus. 6<sup>th</sup> edition: St Louis. Mosby, Inc. 2002. pp 177-182.
7. The Maudsley Personality Inventory by Arthur R. Jensen. Institute of Psychiatry, Maudsley Hospital, University of London. Available at: arthurjensen.net/.../The-Maudsley-Personality-Inventory-1958-by-Arthur-Robert-Jens.
8. Eysenck HJ. The Experimental Analysis of Personality. In: Eysenck HJ. Editor. The Biological Basis of Personality. Charles C Thomas. Illinois. 1967,79-132.
9. Canli T. Functional brain mapping of extraversion and neuroticism: learning from individual differences in emotion processing. J Pers. 2004;72:1105-32.
10. Canli T. Toward a neurogenetic theory of neuroticism. Ann N Y Acad Sci. 2008;1129:153-74.
11. Pu H, Wang Y, Wei Q, Ma HJ, Hu PP, Li SL, et al. Decision-making Impairments in Primary Angle-closure Glaucoma Patients. Chin Med J 2017;130:1424-8.
12. Godtland R. An Investigation into the Relationship Between. Vision and Personality. Journal of Behavioral Optometry 2012, 23:59-62.