PERSONALITY-ATTENTION LINK IN EMOTIONAL OCULOMOTOR GO/NO-GO TASK: A COMPARATIVE STUDY OF PERFORMANCE OF VARYING DEGREES OF EXTRAVERSION AND NEUROTICISM

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Submitted by:
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UNDER THE SUPERVISION OF

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CERTIFICATE

This is certify that the thesis entitled **"Personality-attention link in emotional oculomotor go/no-go task: A comparative study of performance of varying degrees of extraversion and neuroticism"** being submitted in partial fulfillment of requirements for the award of degree of **Master of Arts in Psychology**, submitted in **the School of Humanities and Social Sciences, Thapar University, Patiala** is a bonafide work carried out under the supervision of **Dr. Simerpreet Ahuja,** Professor, School of Humanities and Social Sciences, Thapar University, Patiala and that no part of this project has been submitted for the award of any other degree.

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This is to certify that above statement made by the student concerned is correct and true to the best of my knowledge.

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CANDIDATE'S DECLARATION

I hereby declare that the work presented in this thesis entitled, **"Personality-attention link in emotional oculomotor go/no-go task: A comparative study of performance of varying degrees of extraversion and neuroticism"** in partial fulfillment of the requirement for the award of Degree of **Master of Arts in Psychology**, submitted in **the School of Humanities and Social Sciences, Thapar University,** Patiala, is an authentic record of my own work carried out under the supervision and guidance of **Dr. Simerpreet Ahuja**, Professor, School of Humanities and Social Sciences, Thapar University, Patiala and refers other researcher's work which are duly listed in the reference section.

The matter embodied in this thesis has not formed the basis for the award of any other degree of this or any other university.

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LIST OF ABBREVIATIONS

ERs	Error Rates
E	Error scores related to more emotionally arousing pictures
I	Error scores related to less emotionally arousing pictures
U	Error scores related to unstable emotional stimuli
S	Error scores related to stable emotional stimuli
ACC	Anterior Cingulate Cortex
CEF	Cingulate Eye-field
DLPFC	Dorsolateral Prefrontal Cortex
FEF	Frontal Eye-field
fMRI	Functional Magnetic Resonance Imaging
IPS	Intraparietal sulcus
PCC	Posterior Cingulate Cortex
PEF	Parietal Eye-field
PEM	Pursuit eye movement
PHC	Para-hippocampal cortex
PPC	Posterior parietal cortex
SEF	Supplementary Eye-field
SPL	Superior parietal lobule
TMS	Transcranial Magnetic Stimulation
SEM	Saccadic Eye Movements
RT	Reaction Time
WM	Working Memory
TD	Top-Down Processing

BU	Bottom-Up Processing
LIP	Lateral intraparietal area
SC	Superior colliculus
Bss	Brainstem saccade generators
FEFs	Frontal eye fields

ABSTRACT

Personality and attention are interlinked, as how we respond to the environment is truly dependent on who we are. How we move our eyes, where we look at is of significance in attentional paradigms. Selective visual attention is of significance in visual field. It usually occurs without conscious awareness, and spontaneous reactions are formed which can be seen through eye movement tasks. There are quite a number of researches done on personality and attention. The present study, however, describes about different degrees of extraversion and neuroticism, and how they respond to different set of stimuli favoring each one of them. For this study an emotional variant of oculomotor go/no-go task was chosen. The Eyesenck personality questionnaire (EPQ-R) 90 item was used to measure the extraversion and neuroticism traits. The participants age range varied from 20 to 40 years (M=24.8, S.D=4.04).The present study aims to compare high and low degrees of extraversion and neuroticism with different set of emotional stimuli that may function as trait-congruent system. The results of the study revealed significant differences in degrees of dimensions of personality. Where high extraverts were more responsive towards high emotionally arousing pictures, high neurotics showed an inclination towards unstable emotional stimuli. The impact of extraversion was the highest, among all on high emotionally arousing stimuli. This study endeavors how the tasks that demand deliberate inhibition may be overruled if the stimuli in hand is arousing or matches the interest of person. The present study is beneficial in understanding the intricacies of personality and eye movement tasks.

Keywords: Saccades, anti-saccade task, extraversion, neuroticism, attention, error-rates, personality, emotional oculomotor task

CONTENTS

CHAPTER 1

INTRODUCTION

Overview

The present study talks about the link between attention and personality through an oculomotor emotional go/no-go task. The role of eye movements in visual attention is of major interest to many researchers. How we move our eyes, where we look at is of significance in attentional paradigms. Personality and attention are interlinked as how we respond to the environment is truly dependent on who we are. There are few studies which study the effect of extraversion on emotionally arousing stimuli and their relationship and the effect of neuroticism on stable and unstable emotional stimuli. The study highlights the importance of eye movements with personality of an individual. We consider personality to be more stable determinant of human functioning. So it is crucial to study the relationship between personality and eye movements. Various researches on attention and personality have been conducted. However, no study so far has been conducted to see how personality affects the way we respond to emotional stimuli. No study by far has used emotional elements for go/no-go task to relate to personality dimension. The present study mainly talks about different degrees of extraversion and neuroticism, and how they respond to different set of stimuli favoring each one of them.

Extraverts being more active and impulsive might respond quickly and frequently to a stimuli that is attractive and arousing than the persons who are not extraverts. Introverts being more responsive to low emotion arousing stimuli will react less. In the same way, it's been found that people who are less stable they react more quickly to the stimuli favoring their characteristics. An anxious person's reaction to a stressful environment will be more intense than a person who is low on anxiety. A person who is a pessimist will always respond to negative elements of a situation, disqualifying all the positives. Selective visual attention is of importance in visual field. It usually occurs without conscious awareness, and spontaneous reactions are formed which can be seen through eye movement tasks. People with high impulsivity may respond spontaneously to the more arousing stimuli. The go/no-go tasks require deliberate attention like top down processing of attention operates here. But pictures play a major role here because they

lead to more automatic and less deliberate attempts without conscious awareness which leads to bottom up processing. People make errors while they attempt to look at pictures or move their eyes towards the stimuli that attract their eye. This study favors how the tasks that demand deliberate inhibition may be overruled if the stimuli in hand is arousing or matches the interest of person. The tasks demanding inhibition requires more awareness and consciousness than the tasks that are not inhibitory in nature. Therefore, the elements involved in tasks played a major role of automatic attraction, where the person has to control the impulse and deliberately direct attention towards the said direction or sometimes not to move the eyes. The study aims to differentiate between high and low extraverts and neurotics on different set of emotional pictures. Results of the study showed that high extraverts did poorly with low emotionally arousing pictures, thereby saying that people selectively attend to trait-congruent visual material. The high neurotics attended to unstable emotional stimuli, making the study significant that anxious personalities may focus on the unstable and negative stimuli.

The following describes about the various types of eye movements, the neuronal network involved in anti-saccade task, the saccadic eye movements with psychological disorders, the age differences, the theories related to visual attention and so on.

1.1 Types of eye movements

There are four types of eye movements:

1. Saccades: These are rapid eye movements of the eyes. These usually coalesce (both eyes move together in the same line) and under voluntary control. Saccades can be generated voluntarily, but also reflexively when the eyes are open. Even during our sleep the rapid eye movements occur which is saccades. Saccadic eye movements are trajectory because the saccade eliciting system cannot respond to subsequent changes in the position of the target during the course of eye movement. The purpose of saccades is to bring the images to fall onto the fovea i.e. to bring into focus the particular areas of visual field. They are a major mechanism for selective visual attention. SEM always occurs in straight lines and they are so fast and abrupt, that we don’t see during these movements. We see the world, by the means of a series of saccadic jumps from one to another area, interrupted by

fixations. A fixation occurs when the eye is stationary i.e. not moving. This occurs between saccades, and during fixations, the area imaged on fovea is being visually attended to by the observer. These differ in length, about 200-300 ms, although much longer fixations can occur. The length of fixations tell us much about where the observers' attention and cognitive state. When SEM towards any object is made, then the saccade can either accurately focus the object, or overshoot or undershoot it, giving rise to subsequent small corrective saccades to the object. Most saccades are less than about 15 degrees in size. Saccades can be curved as well as straight. They are very fast with a peak velocity of about 700 degree sec-1. Saccades are preprogrammed ballistic movements such that during the previous fixation, not only is information foveally attended to but also the location of next fixation is determined and a saccade then executed to that location. We can find a good example of saccades when we are reading a book or going through pictures, or while driving a car.

2. Smooth and compensatory pursuit movements: These are conjugate eye movements which smoothly track slowly moving objects in the visual field. They typically require a moving object to elicit them. Smooth pursuit movements are much slower tracking movements of the eyes to keep the moving stimulus on the fovea. Only highly trained observers can make smooth pursuit movements in the absence of a moving target. Compensatory eye movements are smooth compensatory movements which are related to pursuit movements. They act to compensate for movement of the head or body so as partially to stablise an object on the retina. There are alternating slow and fast movement of the eyes in response to stimuli which are called optokinetic nystagmus. When in a train, looking out of the window we look at the tree and follow it as it moves past (slow phase) then make a rapid movement back (fast phase) and fixate it on the next object which again moves past us, is a good example of these movements. These are normal reflexive response of eyes to large-scale movements of visual scene and are differed from pathological nystagmus that can result from different kinds of brain injury like damage to vestibular system or cerebellum.

3. Vergence movements: These are the eye movements where both eyes move in opposite horizontal direction to permit the acquisition of a near or far object. These movements can align the fovea of each eye with targets located at different distances from the observer. These movements are disconjugate/disjunctive as they involve either convergence or divergence of the lines of sight of each eye to see an object that is nearer or farther away. When an object comes towards us then our eyes move together slightly to maintain binocular vision of it. As the object recedes away from us then the two eyes diverge again.

4. Vestibulo-ocular movements: These stablise the eyes relative to the external world, thus compensating for head movements. This is caused by stimulating the semicircular canals as the head is rotated. These reflex responses prevent visual images from "slipping on the surface of retina" as head position varies. When fixating at an object and moving the head from side to side, the eyes automatically compensate for head movement by moving the same distance but in the opposite direction, thus keeping the image of the object at more or less the same place on the retina. Sensory information from semicircular canals directs the eyes to move in a direction opposite to the head movement.

1.2 Brain areas related to saccades and involved in anti-saccades

Anti-saccades are volitional saccades, which require the person to move eyes opposite to appearing peripheral stimuli. There are two operations that are performed:

1. Inhibition function: This function requires inhibition of reflexive SEM to a visual stimuli or target. This inhibition is under the control of DLPFC
2. Intentional functions: This requires the person to direct eyes opposite to the appearing stimuli, which is performed by FEF. FEF is mainly involved in producing volitional and voluntary saccades.

Where pro-saccades (reflexive) and anti-saccades (voluntary) when studied using fMRI, could tell that there is activation in FEF before an anti-saccade task, but not in PEF. Early preparation

is needed by FEF, but not by PEF. There is inhibition of reflexive saccades by DLPFC, and directly on SC, not involving other cortical areas. The LIP control saccadic movements and some attention processes. The neural pathways that are involved in pro and anti saccades involve the areas of Bss, DLPFC, FEFs, LIP and SC.

When there is anti-saccade, following neural pathway is involved. The signals sent from LIP are sent to the SC, there is building of activity for the target location. Simultaneously, LIP sends output to FEFs, where FEFs generates a pre-motor command, together with DLPFC, sends inhibitory signals to the SC to suppress reflexive saccades to the target stimuli.

Cerebral infractions close to the LIP impairs the execution of pro saccades whereas lesions in DLPFC involve suppression of saccades in anti-saccade tasks.
In addition, to fixate a new target, we take two issues:

1. Amplitude of movement (how far)
2. Control of direction of movement (which way/where)

The amplitude of SEM is controlled by lower motor neurons of oculomotor nuclei, whereas direction of eye movement is determined by which eye muscles are activated. Saccades can occur without light or in darkness too, but they often occur when there is some kind of attractive stimuli that captures the attention and directs foveas towards the target.

Two important structures – SC of the midbrain and a region of frontal lobe (FEFs-Brodmann's area 8), plays a role in SEM. It is also noted from lesion studies that damage to FEFs can lead to deficits in deliberate attempts of saccades i.e. antis-saccades, where voluntary direction of eyes is needed.

From this, we can conclude that FEFs play an important role for scanning the environment, the topic of interest and the stimuli that attracts the eye within an array of other distracting stimuli.

1.3 Emotional Oculomotor Go/No-Go task

Go/No-Go paradigm is used in the present research. This is an emotional variant of oculomotor go/no-go task which can measure the spontaneity and impulsivity (counted as errors/ERs) in a task. This requires an ability to inhibit reflexive response, which many impulsive persons have difficulty in. the individuals with predicted levels of impulsivity and anxiety, may make more errors and also have longer RTs. The emotional variant of the task chooses several pictures of interest, which attracts the subjects' eyes. By using affective stimuli in oculomotor tasks, we can judge the amount of response or what actually favors the sight of onlooker.

1.4 Anti-saccade task

The anti-saccade task requires the participants must inhibit the reflexive response to peripheral stimuli and must look away to its opposite direction. There are two operations required here: Inhibition of reflexive and automatic to peripheral flashed stimuli. Deliberate attempts to direct attention towards an opposite/mirror position. Performance of anti-saccade and pro-saccade is different as they both differ on goals of compatibility.

An anti-saccade task is based on Stimulus-response (SR) mapping task. It is SR compatibility task. Where pro-saccade, a saccade directed towards a flashed peripheral stimuli, requires congruent SR mapping, an anti-saccade requires incongruent SR mapping. RTs are faster and responses are seen as more accurate, when the stimulus and response are compatible.

A similar task is Simon task, which requires auditory attention. Here, different tones in left or right ear are presented, the subject has to press left/right key according to the pitch of the tone. When the key and tones are compatible in sides, RTs are faster. Other tasks like Erikson flanker task, requires subjects to press key based on central letter. It was noted that RTs were faster when central letters and flanking letters were compatible. In Stroop tasks too, RTs are faster when print color and color names are compatible.

1.5 Visual Attention Theory

The go/no-go task works on the selection and rejection of targets within an array of distracters. This task is based on visual attention theory-A Boolean Map theory. It is based on selective attention that gives access to consciousness. It talks about two kinds of limitations in visual attention:

1. Principle of access: This relates to the information that can be contained in a Boolean map. A Boolean map is a special representation in visual scene that contains two opposite and contrasting subsets: the region that is selected and the region that is not selected. If two objects are presented at one time, like a circle and a triangle, then object would be missing from selected region of map. If both are chosen, there is no possibility of differentiating in featural properties of objects w.r.t shape, or any other property. Boolean means that one visual field is divided into two (twin/Boolean) levels. It talks about featural labels. This as a whole can have single attribute label per dimension. This single label can provide the description of whole region. When in the above example of circle and triangle, there is a label of shape given; this shape can't provide access to circle or triangle. To access the shape, one needs to create a Boolean map that covers only one set of labels- circle or triangle and not both. It says that only one feature value per dimension in Boolean map can be seen. An observer's conscious awareness of visual scene can be represented by single labeled Boolean map.

2. Principle of Selection: It relates to the ways to create a Boolean map. There are ways, the map is created. It takes place :

a) By selecting only one attribute value per dimension. For example: selecting all round objects in the visual scene (for label-circle). This results in a labeled Boolean map, extending over the region comprising all round things.
b) By combining the existing map with output of first route (selection based on feature) via the operations of intersection and union.

   What is accessed in Boolean map?

There are possible tenets:

i) Obligatory encoding of location
ii) Unitary attribute access (one attribute value can be accessed at one time)
iii) Many locations can be acquired at a time

The creation of Boolean map is based on other two tenets:

i) Attribute by attribute selection (selection based on only one attribute at a time).
ii) Availability of Boolean operations (any selection not directly practiced by selection based on single attribute value must be created through Boolean operations.

1.6 Global effect

Global effect is of significance to visual attention and eye movements' field. When the end point of an eye movement is not positioned at the center of target stimuli, and deviates in the direction of another stimuli or element, it is called global effect. This global effect can influence oculomotor behavior. In our environment, we make REM. These are fast jerky movements- which are saccades (already discussed in 1.1). Where our eyes land is actually an area of interest to many researchers and as it is an indicator of selective visual attention. Many studies have been done on global effect. An observation by Levy Schoen (1969), latency is increased when there is an additional element i.e. in presence of non-targets, the saccadic latency is higher. The location was also of significance where the saccade length was longer when non-targets were presented beyond the target. It was shorter when presented in between the target and fixation point. It has been found that properties of a stimulus are of importance in global effect. There are four properties that can affect global effect:

a) Location of stimulus: Coren & Hoenig (1972) showed that deviation of saccade endpoint in the direction of non-target was strongest when it was positioned in between the target and fixation. Findlay in one study, found elements closer to fixation, attracted the saccade endpoint.

b) Size of stimulus: The largest stimuli among the two stimuli would attract the saccade endpoint (Findlay, 1982).
c) Intensity of stimuli: The stimulus with the brightest intensity will have closer saccade endpoint.
d) Background similarity: Where there is dissimilarity between the element and background, the saccade endpoint is positioned closer to that, as compared to similar kinds of elements against a background.

In addition, the global effect is influenced by the stimulus distance. When both elements on horizontal visual field are presented in the same left or right visual field, there is same distance to the fixation point. The global effect is usually seen when the distance between the stimuli is small. The specific zone is there, where the global effect occurs.

Walker & colleagues in an experiment found that only when distracter is presented in 20 degree angular distance, the saccade amplitude was affected. Global effect occurs when the elements are actually held closer to each other.

In a study done by Chou et al (1999) on monkeys, found that the global effect is associated with express saccades. These saccades have very short latency (<100ms). The higher-order signals too can affect the global effect. In a study by He & Kowler (1989), where the probability of target appearing location in one of two locations was varied, the saccades were initiated towards the probable and expected location, not where the target actually was. Therefore, the endpoint of an eye movement is also influenced by the expectancy or predicted location of the target. The global effect is less seen when the information is given in steps or trial to trial basis on where the target is to be presented. Also, when there are specific instructions given for a task, this influences global effect. Global effect was when no specific instruction was given regarding specific target element compared to situation in which target was specified.

1.7 Top-down and Bottom-up processes in visual attention

Selective attention is an important feature, as it helps in filtering out the relevant stimuli from the less relevant or irrelevant stimuli. In this way, information taken in can be responded to quickly and efficiently.

There are two processes that operate in attention:

1. Bottom-up processes
2. Top-down processes

In bottom-up processes, the information is selected automatically. The highly attractive stimuli or features can capture the attention. However in top-down processes, attention is deliberate, and actively sought out. It is more voluntary in nature. In bottom-up processes, the elements of stimuli are of significance. If the stimuli features differ significantly, 'pop-out' effect can be seen, where they differ from background elements in terms of color, size, orientation etc. These processes occur simultaneously without the need to look over or pay attention to every element in view. In top-down processes, the target needs to be examined through much detail and it is generally intentional and voluntary. There is mutual interaction between the two processes.

There are two kinds of maps operating here:

1. Saliency map: This represents the most salient stimulus in visual field. Attention is directed to that spot on the map where there are most salient and important features present.
2. Priority map: Here the attention is directed to the current goals i.e. what is important.

Both these processes need a co-activation of same network of parietal and prefrontal cortical areas. When a stimulus that stands out of the background is selected, neural activity takes place. Most salient features are represented predominately at all stages that can lead to bottom-up processes. PPC and PFC are areas that are responsible for stimulus selection. For maps of

saliency, areas of brain include, FEFs, area 46 of PFC, LIP,PPC,SC and substantia nigra. DLPFC and FEF represent salient stimuli in 'odd-ball stimulus tasks', where the stimulus differ in color or shape from background elements (Sato & others, 2003; Schall &Hanes, 1993; Schall & others, 1995; Thompson & others, 1996). It was also found by Gottleib & others (1998); Kusunoki & others (2000), that LIP neurons represented a visual stimulus more strongly when the stimulus was made salient by being flashed as surrounding stimuli were kept stable, compared to the condition in which the same stimulus was not flashed. Higher cortical areas such as PFC and PPC are a source of top-down influences.

1.8 Age differences in anti-saccade task

In many researches, there are age class deficits in attentional inhibition. There are differences in oculomotor responses that can be attributed to different age groups.

Olincy et al (1997), found age-associated increases in both anti-saccade latency and errors. Butler et al (1999), Niewenhuis et al (2000), Bojko et al (2004), Crawford et al (2005), studied age-related differences in anti-saccade task.

Attentional capture studies measure the ability to inhibit disturbances to a saccade. There are other tests like DOR (delayed oculomotor response) task for saccadic inhibition.

1.9 Brain motivational systems

Gray (1989, 1994) has given two kinds of motivational systems that are neurologically and psychologically different. One is Behavioral activation system (BAS), which is usually activated by cues of reward and non-threatening/punishing stimuli. It promotes approach behavior. Another is Behavioral inhibition system (BIS), which is avoidance system that encourages behavioral inhibition, increased arousal and directing of attention towards relevant cues. These are related to personality dimensions. The differences in reactivity and attention towards the relevant cues play an important role. While BIS is related to trait anxiety, BAS is associated with impulsivity. Where aversive motivation results from BIS activation that can be seen among

neurotic introverts to the stable extraverts' quadrant. Appetitive motivation results from BAS activation running from stable introverts to neurotic extraverts' quadrant. Reactivity of both motivational systems are measured by Sensitivity to Punishment & Sensitivity to Reward Questionnaire (SPSRQ; Avila 2001; Torrubic, Avila, Molto & Caseras 2001).

CHAPTER 2

LITERATURE REVIEW

2.1 Extraversion and Neuroticism: Linking attention with personality

Attention and personality has a direct link in oculomotor tasks. In one study by Hutton & Ettinger (2006), specifically extraversion is a contributor to the variability in errors (ranging between 5% & 25%) in anti-saccade task. In studies of fMRI, there were extraversion-related differences in brain activity in anti-saccade control (Kumari et al 2004). It is believed that extraversion is marked by sociability and a preference for physical activity (Eyesenck, 1967) and sometimes impulsivity (Dopue & Collins, 1999).

It was found by Posner & Peterson (1990) that spatial orienting is supported by posterior parietal cortex whereas detection or discrimination is supported by anterior cortex.

Extraversion is also related to aspects of psychopathology (Dinzeo & Docherty, 2007). High extraversion is being associated with reduced risk of psychosis and better quality life but poorer work functioning with schizophrenic patients. Arousal plays an important role in vigilance tasks. According to arousal theory of personality (H.J. Eyesenck, 1967), introverts have higher cortical arousal than extraverts and therefore, can perform at low levels of arousing stimuli. It was found that extraverts are prone to under arousal and there is slow performance decrement during vigilance tasks. There is a close connection between arousal and vigilance tasks (Koelegh, 1992).

Eyesenck (1967) had proposed that introverts have higher basal cortical arousal than extraverts. There was an inverted U-shaped relationship between cognitive performance and arousal. Therefore, it was concluded that introverts show greater performance at tasks which are less arousing, as they start higher on the curve. If the external arousal is increased, extraverts perform better and can surpass introverts. It was found that if the tasks like volitional saccadic initiation are demanding, extraverts make fewer errors and are faster. If the tasks are monotonous or

boring, the introverts are at advantage. In a study by Derryberry & Reed (1994), it was found that extraverts are slow when they have to shift their attention from positive locations, while introverts are slow in shifting attention from negative ones. Fox, Russo, Bowles & Dutton (2001), found that high level anxiety individuals have trouble in disengaging attention from threatening stimuli. Studies of attentional blink paradigm revealed that anxiety and neuroticism can predict longer attentional blink costs, and openness and extraversion can predict smaller attentional blink costs (Bredeweier, Berebaum, Host&Simons, 2011; Maclean&Arnell, 2010).

These studies suggest the individual differences as personality traits in attentional control and disengagement. Gaze has a significant role in attention. Researchers have shown that personality traits are associated with individual differences in eye movement control (Issacowitz 2005, Rauthmann, Seubert, Saehese & Further, 2012). Issacowitz (2005) found that there were fewer number of fixations on negative images among optimists than pessimists.

Rauthmann et al (2002) found that there were longer fixation times and fewer fixations with high levels of neuroticism. It was also found that extraversion was associated with shorter fixation times and higher number of errors. Affective states play an important role in personality. Watson & Clark (1992) found that extraversion was associated with positive affect and neuroticism with negative one. Perman et al. (2009) had conducted an eye-tracking experiment, where different set of emotional facial expressions were used. Results of the study revealed that neurotics spent more time looking at the eyes of fearful faces. Eizenman et al. (2003) in a trait congruency model, supported the study, and said that people search for the information that is congruent to their personality traits.

Easterbrooks (1959) in a cue-utilization theory, said that tension leads to a decreased number of cues utilized from environment. This leads to narrowed attentional breadth. Research has supported that positive affect broadens and negative affect narrows the scope of attention [Friedrickson & Braonigam (2005); Rowe, Hirsh& Anderson (2007)].

In a study by Derryberry & Reed, extraversion was associated with wide attentional breadth and hence greater prediction of increased change detection performance and neuroticism on the other

hand, was correlated with decreased attentional inhibition and eye movement. It was found that neurotics had performed poorly on anti-saccade tasks and ERs were significantly high.
In a research by Basso, Schefft, Ris & Dember (1996), positive mood and optimism were associated with global bias and anxiety and depression with local bias. This tells about the relationship between affect and attention. It is found that trait anxiety has been repeatedly associated with increased attention to threatening cues (Avila & Parcet 2002b; Mathews & Mackintosh, 1998), where impulsivity is associated with increased attention towards reward stimuli (Avila & Parcet, 2002a; Derryberry & Reed, 1994).

2.2 Attention in anxiety and impulsivity

It has been found by Mathews & Mackintosh (1998) that anxious individuals emphasize their attention on threat-related material, in presence of challenging neutral stimuli. There is great evidence that supports that anxiety is associated with increased distractibility and poor response inhibition. Avila & Parcet (2002) found that danger-related biases in anxious individuals were related to activation of anterior network.

In a study by Eyesenck (1992), anxious individuals have likelihood to be hyper-vigilant and scan the surroundings repeatedly regardless of the aversive stimuli. This results in higher disturbances by peripheral events, and problems in maintaining the focus of attention on one fixation point (Shapiro & Liu, 1989). The hyper-vigilance pattern is related to higher activity of posterior network in reaction to peripheral changes. According to The Attentional Control Theory (ACT; Eyesenck, Derakshan, Santos & Calvo, 2007), there is an increase in the influence of stimulus-driven processing resulting in poor executive attentional control. This harms the central executive functions of inhibition. Inhibition is a function that helps in filtering information that is relevant from irrelevant salient stimuli. This is believed to play a significant role in a number of domains including selective attention, perception, memory, problem solving and motor control (Dempster & Corkhill, 1999; Kok, 1999; Macleod Dodd, Sherd, Wilson & Bib, 2003). Few researches have been conducted on impulsivity. Shapiro (1965) found that impulsive individuals are attracted towards objects of immediate, concrete and personal relevance.

According to Friedman & Miyake (2004), the function of inhibition has two components:

1. Response inhibition
2. Resistance to intrusion from distracters

Much evidence of anxiety, impairing inhibition has received support from the research assessing distractibility in the presence of emotional material (Cisler & Koster, 2010). Derakshan & Erikson, however, proposed that anxiety can influence inhibitory control in absence of affect and threat-related stimuli.

Dickman (1993), in proposals of impulsivity relates it to a greater capacity to shift attention through area; this depends on higher activity in dopaminergic pathways. Avila, Barros, Ortet, Parcet & Ibanez, said that the response is stronger in individuals with overactive BAS. In anxious individuals, this shifting capacity is upturned when reward stimuli are detected (Avila, 1995; Derryberry & Reed, 1994). Avila & Parcet found that impulsive individuals focused less on neutral spatial location and focused more on reward/expected targets.

Derakshan et al (2009) found that high anxious individuals had extended anti-saccade latencies than low anxious. The two groups, however, differ in ERs. No differences could be seen in pro-saccade task. This tells us that anxiety impairs inhibitory response to stimuli.

In a finding by Ansari & Derakshan (2010), confirms that slower anti-saccade latencies in anxious individuals was not caused by damaged volitional action generation but because of impaired inhibitory control. ACT takes into account two processes. One is effectiveness which is the ability to do the task and is measured by ERs. Another is efficiency which deals with manner and is measured by RTs. Anxiety is more likely to impair efficiency and not effectiveness (Ansari & Derakshan,2010; Ansari & Derakshan in press; Ansari, Derakshan & Richards,2008).

2.3 Saccades in psychological disorders

Abnormalities in SEM are visible in psychiatric and psychological disorders. There are irregularities in sensorimotor integration in disordered people. SEM is used as an instrument to evaluate attention.

There are two types of saccades. In Pro-saccades, the gaze is directed towards the appearing stimuli or target of interest. SC plays an important role in initiation of these saccades. It has a negative relation with latency, if the activity of SC is high, there is faster movement to search for target. Another form of saccade is volitional and voluntary saccade, where instead of looking at the peripheral target, you have to direct your gaze in the opposite direction. There are two measures to assess anti-saccades. One is through response latencies and the other is through a number of directional errors, this tells about problems in inhibiting a response.

Some studies have been done on various psychological disorders. Depression is usually characterized by slowness and decreased activity, slowing up of mental processes, fatigue, apathy and irritable mood. Depressed patients have low level of motivation, which influences their attentional processes and engagement. Anti-saccade task allows us to assess deficiencies in attentional processes in depressed patients.Sweeney et al on a group of depressed subjects found that these patients had high rates of error suppression in anti-saccade task. There were also memory problems in spatial memory and increased saccadic intrusion during visual fixation. These patients had great difficulty in suppressing saccades in anti-saccade task, but there was no difference in speed or latency. In a study conducted by De Lissnyder, depressed patients had longer RTs in anti-saccade tasks. In one study done by Winograd-Gurvich et al, depressed patients had higher number of errors and high latency in saccadic tasks. They also found differences in melancholic and non-melancholic depression. Melancholic depressed patients showed motor inhibition and slowness, just like in Parkinson’s patients, there is difficulty in initiation of movements. There is increased latency and reduced peak velocity. Mahlberg et al found that patients with depression had longer RTs.

In ADHD, patients are characterized by of inattention, hyperactivity and impulsivity associated with inappropriate behavior. These people have difficulty in tasks of response inhibition and also on tasks of working memory and motor and cognitive activities. In ADHD patients, neural circuits are affected. There are changes in structure of frontal lobes, caudate nucleus and corpus collosum. The fronto-stratial and fronto-parietal areas are affected. ADHD patients are characterized by distractibility. They are slower to inhibit reflexive inhibit reflexive saccades, and commit more errors. Higher ERs in ADHD during anti-saccade task can be attributed to deficiency in dorsolateral pre-frontal cortex and basal ganglia. In a study done by Feifel et al it was found that during pro-saccade task, these subjects generated more pre-mature saccades with RTs of less than 90ms. There were more directional errors observed in ADHD patients. Gould et al found that ADHD patients made more intrusive saccades during fixation. Goto et al found dysfunction in response inhibition in these patients.

In patients with high anxiety, there were no improvements in saccade latency as compared to low anxiety group (Ansari & Colleagues). In a study of Weiser et al. in an affect saccade task, facial expressions (happy, angry, fearful, sad, and neutral) were shown to a group of socially anxious individuals. The results revealed that there were more errors in anti-saccade; they exhibited difficulty in inhibiting a response to facial expressions. It was shown that there were dysfunctions in the pre-frontal areas that are involved in attention. Derakshan et al found that high anxiety group had longer anti-saccade correction latency than low anxiety group, and also the effect was greater with the danger-related stimuli than with positive or neutral areas.

2.4 Emotional pictures influencing anti-saccades and pro-saccades

In the realm of attention, an object's physical characteristics play a major role. Affect and emotion are crucial to attention. Researchers have investigated on how the content of complex pictures affects ocular-motor behavior. When visual stimuli violate subjects' expectations, then it influences eye movements. In an experiment, where altered details (inverted heads, green hands) were shown, subjects' eyes are directed towards the altered detail quickly than when the appearance is normal (Becker et al, 2007). Emotional pictures play an important role in attention and subsequent eye movements. In a study by La Bar et al (2000), when neutral stimuli was

paired with an emotional stimuli and presented simultaneously, eye movements were affected by affect in pictures. Calva & Lang (2005) found that unpleasant and pleasant pictures attract the initial fixation than neutral pictures when both are presented simultaneously. Moreover, emotional pictures are also fixated for a longer period of time. Nummenmaa et al (2006) found that under free-viewing instructions, participants directed saccades towards the emotionally arousing stimuli. It was observed that fixation duration was longer and pleasant pictures were favored more. Even under competing task instructions, emotional pictures were attended to first and more frequently and for a longer time than neutral pictures.

CHAPTER 3

Motivation, Objectives, Rationale and Hypotheses of the study

3.1 Motivation of the study

Researchers so far, have favored the gender differences, the age differences and differences among various psychological disorders in anti-saccade and go/no-go tasks. Personality and attention are interlinked as how we respond to the environment is truly dependent on who we are. Extraverts being more active might respond quickly and frequently to a stimuli that is attractive than the persons who are not extraverts. Introverts being more responsive to low emotion arousing stimuli will react less. In the same way, it's been found that people who are less stable they react more to the stimuli favoring their characteristics. An anxious person's reaction to a stressful environment will be more profound than a person who is low on anxiety. A person who is a pessimist will always respond to negative elements of a situation, disqualifying all the positives. In a study done by Huong Nguyen, Jason B. Mattingley, Larry A. Abel , it was proved that extraverts' performed lowly on antisaccade task. This study focused on extraverts' making more errors than introverts on antisaccade task. Another recent study by Sowon Hahn, Daniel R. Buttaccio, Jungwon Hahn & Taehun Lee (2015) could link personality and attention and how levels of neuroticism and extraversion can predict attentional performance during a task of change detection and search. Little research has been conducted on eye movements and personality. Various researches on attention and personality have been conducted. However, no study so far has been conducted to see how personality affects the way we respond to emotional stimuli. No study by far has used emotional elements for go/no-go task to relate to personality dimension. The present study mainly talks about different degrees of extraversion and neuroticism, and how they respond to different set of stimuli favoring each one of them.

3.2 Research gaps

The studies have been interlinking personality and visual attention from long ago. So far, studies have been conducted on extraversion and introversion, where extraversion, characterized by high impulsivity and sociability, perform lowly on inhibitory tasks. The present study is unique in

some aspects. Here, an emotional oculomotor go/no-go task was used, where people respond to the emotional stimuli, according to the traits they possess. The affect role, has played a significant role here, as people with different degrees of extraversion, react differently to a given set of emotional pictures. Most studies have been conducted on western cultures, this study is unique in the sense that it is done in Indian settings.

3.3 Objectives of the study

The main objective of the study was to explore how personality and attention are interlinked. The role of eye movements in visual attention is of interest to many researchers. How we move our eyes, where we look at is of significance in attentional paradigms. We formulate certain aims to study this phenomenon.

1. To compare high and low extraverts with more emotionally arousing pictures.
2. To compare high and low extraverts with low emotionally arousing pictures.
3. To compare high and low neurotics with unstable emotional stimuli.
4. To compare high and low neurotics with stable emotional stimuli.

3.4 Hypotheses

The present study was conducted to see how personality and attention are interlinked through emotional go/no-go task; how there exists difference in performance when degrees of extraversion and neuroticism vary. Most researches have been conducted on eye movements but very few of them relate to personality. However, no study by far has used emotional elements for go/no-go task to relate to personality dimension.

Extraversion is signified by sociability, a preference for physical activity and sometimes impulsivity. In previous studies, Eyesenck (1967) proposed that introverts' basal cortical arousal was higher than extraverts and that cognitive performance and arousal showed an inverted U-shaped connection. Thus, introverts perform better than extraverts on tasks which are less

arousing. Extraverts improve when there is high level of arousal. Based on this rationale, following hypotheses (H1 and H2) are postulated:

1. High extraverts will have more ERs with more emotionally arousing pictures (as in E column) as compared to low extraverts. (H1)
2. High extraverts will have less ERs with less emotionally arousing pictures (as in I column) as compared to low extraverts. (H2)

In one study, it was shown that personality traits are related with individual differences in eye movement's control. Issacowitz (2002) found that optimists had a fewer number of fixations on negative images than pessimists did. Rauthmann et. al (2012) found that individuals with more levels of neuroticism displayed longer fixation times and a fewer number of fixations while extraversion was related with shorter fixation times and a more number of fixations. Based on the rationale following hypotheses (H3 and H4) were made:

3. High neurotics will have more ERs with unstable emotional stimuli (as in U column) as compared to low neurotics. (H3)
4. High neurotics will have less ERs with stable emotional stimuli (as in S column) as compared to low neurotics. (H4)

3.5 Experimental variables

Independent variables

Dimensions of personality: Degrees of extraversion and Degrees of neuroticism

Dependent variables

Error rates in E, I, U and S column.

CHAPTER 4
Methodology

4.1 Materials required

4.1.1 Questionnaires

Eyesenck personality questionnaire- revised (EPQ-R) 90 item scale was used to screen out extraverts, introverts, and high and low neurotic people.

4.1.2 Experimental hardware and software

The experimental task was developed using an eye movements' app- Focus Builder App, developed by Neurd solutions, LLC (version 3.2.17).The app contains a variety of exercises which challenge users to voluntarily move their eyes in various patterns, speeds and directions. There were different exercises to be performed. Anti saccade exercise was chosen for the study go-no-go option. This was presented on a computer screen, facing the chair/person. At the back of the person, a split image of the monitor screen was presented, so that the random dot movements can be captured simultaneously with eye movements via video camera. Samsung ST72 16.2MP 3 inch TFT LCD DIGITAL camera was used to capture the eye movements and the screen. It was fixed on a tripod stand, behind the monitor screen, facing slightly above to capture the front view. A lampshade was used to have the clear picture of the eyes.

4.1.3 Task stimuli

The emotional go/no-go task was used, that consisted of random dots and pictures, 3 images were chosen for each of the categories, pertaining to high extraversion (more emotional arousing pictures), low extraversion (less emotional arousing pictures), emotionally stable and unstable pictures.

4.2 Participants

Participants were randomly chosen. There were 80 participants who were provided a consent form and a questionnaire (EPQ-R); EPQ-R was used to screen out low extraverts and high extraverts and emotionally stable and unstable people. The age range varied from 20 to 40 years (M=24.8, S.D=4.04)

4.3 Experimental design

The experiment was designed with the help of focus builder app. There were 2 monitor screens, one facing the person, so that he / she could respond to the random occurrence of dots and the other one facing the experimenter, kept just adjacent to the subject in such a way that a split image could be formed just it had been shown on the original monitor screen. The video camera was held by the tripod stand just behind the monitor facing the second screen and the person. a lampshade was kept on the other side of the person, so that the eye movements can be fairly recorded. The experiment task was such that, the monitor screen presented a fixation dot at the center (a black dot). A go/no-go task was chosen for the study. It was instructed that when a dot changes to an image, so that you don't have to move your eyes and keep them fixed on the centre dot. However, if a red dot appears, then look at the mirror location of the appearing or blinking red dot. The background color was chosen as grey. The dot size was large and clear enough to detect. In each trial, there were 6 repetitions. Every image was filtered on a grayscale to nullify the color effect. The left/right blinks were in a ratio 5/5. There were options to choose the no. of dots, it was chosen as 2 instead of 3. The dot blinked at every 4 second interval. There were in total 13 trials, containing 3 high emotionally arousing pictures (pertaining to extraversion characteristics), 3 low emotionally arousing pictures (pertaining to low extraversion characteristics), 3 with highly unstable emotional stimuli (pertaining to high neuroticism characteristics) and 3 with stable emotional stimuli (pertaining to low neuroticism characteristics). There was one instructional trial before starting the actual experiment.

4.4 Procedure

Participants were initially informed that the present study examined attentional processes using eye-tracking. On obtaining written consent, participants completed the Eyesenck Personality Questionnaire-Revised (EPQ-R). Participants were then seated on a cushioned chair in front of the monitor screen and the video camera. Participants were informed that they would be presented with a number of trials in which their eye movements would be recorded. The experiment was a go-no go task i.e. when a dot changed to an image they don't have to move their eyes and fixate it at the centre dot. However, if a red dot appears then they have to look at the mirror position of the appearing dot.

The background was grey in color. There were in total 13 trials. The very first trial was instructional. The other 12 were the experimental trials, containing 3 high emotionally arousing pictures (pertaining to high extraversion characteristics), 3 low emotionally arousing pictures (pertaining to low extraversion characteristics), 3 with highly unstable emotional stimuli (pertaining to high neuroticism characteristics)and 3 with stable emotional stimuli(pertaining to low neuroticism characteristics). The EPQ-R was a 90 item questionnaire which required subjects to respond in either yes or no. the questions were related to their personality and how they work in everyday life. There were 4 categories to be scored i.e. Psychoticism (P), Extraversion (E), Neuroticism (N) and Lie scale (L). But for this study, only Extraversion (E) and Neuroticism (N) categories were chosen to be scored. In this way scoring was done with the help of scoring key. There were in total 4 pages. Each page had a different coring as 0, 1. Then with the help of scoring key, total scores were added up and results were interpreted accordingly.

A record form was built to score the go-no go task. The video was used to record the occurrence of random color-image blinks. The direction in which it was blinked was noted down, accordingly the error rates were noted down. The error rates were counted as 0, 1, and 2. If the person looked at the image ,or even if he/she moved his/her eyes from the fixation dot, the error was counted as 2.if he person looked at the red dot when it blinked, and didn't move his her eyes to the opposite side the error was noted as 1. If the person followed the instructions well as, when the red dot blinked, he moved his/her eyes to the opposite side the error rate is zero. If there is an

image blink and he/she fixates his/her eyes at the centre, then also the error reduces to zero. In this way for every trial, there is a score. The scores were cumulative in the sense that there was cumulative high emotionally arousing pictures error score (E1+E2+E3). Similarly cumulative low emotionally arousing pictures error score (I1+I2+I3), cumulative stable score (S1+S2+S3) and cumulative unstable score (U1+U2+U3). In this way the, there were 4 cumulative set of scores as E, I, S, U. these scores were then noted and analyzed.

4.5 Statistics used

The descriptive statistics (with mean and standard deviation) was computed for types of errors (E, I, U and S score) for high, low and total degree of errors. Another descriptive statistics was used for dimensions of personality (extraversion and neuroticism) for high, low and total degree of dimension. Two t-tests: two sample assuming equal variances was used to compare high and low extraversion and ERs in E and I columns. In the same way it was used to compute to see difference in high and low neuroticism and ERs in U and S column. Then correlation of error scores in E and I column with extraversion dimension and U and S column with neuroticism dimension was computed. Regression analysis was used for prediction in E error score and I error score, taking Extraversion (E) as predictor. Regression analysis was used for prediction in U error score and S error score, taking Neuroticism (N) as predictor.

CHAPTER 5

Results

The mean and standard deviation of types of error scores for high, low and total degree of errors is given in table 1

Table 1: Mean and standard deviation of types of error scores (E, I, U and S score) for high, low and total degree of errors.

Type of error scores	**High**		**Low**		**Total**	
	Mean	St. dev	Mean	St. dev	Mean	St. dev
E error score	13.95	1.176	5.75	2.51	9.85	4.56
I error score	5.8	2.41	12.95	1.82	9.375	4.17
U error score	11.75	3.01	7.62	2.71	8.25	3.45
S error score	7.1	3.36	9.4	3.17	9.68	3.53

*NOTE: N=80

The above table shows descriptive statistics (mean and standard deviation) of types of error scores (E, I, U and S score) for high, low and total degree of errors.

The mean and standard deviation of dimensions of personality for high, low and total degree of errors is given in table 2

Table 2: Mean and standard deviation of dimensions of personality (Extraversion and Neuroticism) for high, low and total degree of dimension.

Dimensions	**High**		**Low**		**Total**	
	Mean	St. dev	Mean	St. dev	Mean	St. dev
Extraversion	19.25	1.03	12.7	2.08	16.5	3.8
Neuroticism	18.37	2.57	12.82	2.43	15.6	3.74

*NOTE: N=80

The above table shows descriptive statistics (mean and standard deviation) of dimensions of personality (extraversion and neuroticism) for high, low and total degrees of dimension.

The t value and mean and standard deviation for high and low extraversion and ERs in E column is given in table 3.

Table 3: A t-test: two sample assuming equal variances for high and low extraversion and ERs in E column.

t-Test: Two-Sample Assuming Equal Variances				
E ERROR	**MEAN**	**ST. DEV.**	**t value**	**No. of obs**
HIGH	13.95	1.176		
LOW	5.75	2.51		
t stat. value*			18.72	
				80

*p<0.01

The above table shows a t- test: two sample assuming equal variances. The mean and standard deviation of high E error is 13.95 and 1.17 (M=13.95, S.D=1.17) whereas the mean and standard deviation of low E error is 5.75 and 2.51 (M=5.75, S.D=2.51). The‘t’ value of high E and low E is 18.72 [t (df=78) =18.72 p<0.01]. It shows that there are significant differences between high and low extraverts, as they showed drastic significant differences in ERs when treated with more emotionally arousing pictures (as in E column), meaning that high extraverts showed more ERs as compared to low extraverts when treated with more emotionally arousing pictures.

The t value and mean and standard deviation for high and low extraversion and ERs in E column is given in table 4.

Table 4: A t-test: two samples assuming equal variances for high and low extraversion and ERs in I column.

t-Test: Two-Sample Assuming Equal Variances				
I ERROR	**MEAN**	**ST. DEV.**	**t value**	**No. of obs**
HIGH	5.8	2.41		
LOW	12,95	1.825		
t stat. value*			-14.96	
				80

*p<0.01

The above table shows a t- test: two sample assuming equal variances. The mean and standard deviation of high I error is 5.8 and 2.41 (M=5.8, S.D=2.41) whereas the mean and standard deviation of low I error is 12.95 and 1.82 (M=12.95, S.D=1.82). The‘t’ value of high I and low I is (-) 14.96 [t (df=78) =14.96 p<0.01]. It shows that there are significant differences between high and low extraverts, as they showed drastic significant differences in ERs when treated with less emotionally arousing pictures (as in I column), meaning that high extraverts showed less ERs as compared to low extraverts when treated with less emotionally arousing pictures.

The correlation of error scores in E and I column with extraversion dimension of personality is given in table 5.

Table 5: Correlation of error scores in E and I column with Extraversion dimension of personality.

Correlation of total E and I error score with total extraversion		
	E	**I**
Extraversion	0.78	-0.75

The above table shows correlation of total E and I error score with total extraversion and the obtained value of E score with extraversion is (r=0.78) positive and there is a strong relationship between the two factors whereas I error score shares a negative strong correlation [r= (-) 0.75] with extraversion.

The regression analysis for prediction in E error score taking predictor as Extraversion is given in table 6.

Table 6: Regression analysis for prediction in E error score taking predictor as Extraversion (E).

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig. .000	R SQUARE
		B	Std. Error	Beta			
1	(Constant)	-5.673	1.432		-3.962	.001	0.613
	E	0.972	.087	-.783	11.121	.001	

Dependent Variable: E SCORE

Predictor: (Constant), E

To predict E error score, Extraversion dimension was used as a predictor in Regression table 6. This explains 61% of variation in E error score (dependent variable) attributed to Extraversion [R square=0.613]. B value explains that one unit increase in extraversion leads to 0.97 increase in E error score.

Regression analysis for prediction in I error score taking predictor as extraversion is given in table 7.

Table 7: Showing regression analysis for prediction in I error score taking predictor as Extraversion (E).

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig. .000	R SQUARE
		B	Std. Error	Beta			
1	(Constant)	23.13	1.38		16.8		0.57
	E	-.86	.084	-.758	-10.25	.001	

Dependent Variable: I SCORE

Predictor: (Constant), E

In the same way, Extraversion dimension was used as a predictor in Regression table 7.This explains 57% of variation in I error score (dependent variable) attributed to Extraversion [R square=0.568]. B value explains that one unit increase in extraversion leads to 0.86 decrease in I error score.

A t value and mean standard deviation for high and low neuroticism and ERs in U column is given in table 8

Table 8: A t-test: two sample assuming equal variances for high and low neuroticism and ERs in U column

t-Test: Two-Sample Assuming Equal Variances				
U ERROR	MEAN	ST. DEV.	t value	No. of obs
HIGH	11.75	3.01		
LOW	7.62	2.71		
t stat. value*			6.41	
				80

*p<0.01

The above table shows a t- test: two sample assuming equal variances. The mean and standard deviation of high U error is 11.75 and 3.01 (M=11.75, S.D=3.01) whereas the mean and standard deviation of low U error is 7.62 and 2.71 (M=7.62, S.D=2.71). The‘t’ value of high U and low U is 6.41 [t (df=78) =6.41 p<0.01]. It shows that there are significant differences between high and low neurotics, as they showed drastic significant differences in ERs when treated with unstable emotional stimuli (as in U column), meaning that high neurotics showed more ERs as compared to low neurotics when treated with unstable emotional stimuli.

A t value and mean standard deviation for high and low neuroticism and ERs in S column is given in table 9.

Table 9: A t-test: two samples assuming equal variances for high and low neuroticism and ERs in S column.

t-Test: Two-Sample Assuming Equal Variances				
S ERROR	MEAN	ST. DEV.	t value	No. of obs
HIGH	7.1	3.36		
LOW	9.4	3.17		
t stat. value*			-3.14	
				80

*p<0.05

The above shows a t- test: two sample assuming equal variances. The mean and standard deviation of high S error is 7.1 and 3.36 (M=7.1, S.D=3.36) whereas the mean and standard deviation of low S error is 9.4 and 3.17 (M=9.4, S.D=3.17). The‘t’ value of high S and low S is (-) 3.14 [t (df=78) =3.14 p<0.05]. It shows that there are significant differences between high and low neurotics, as they showed significant differences in ERs when treated with stable emotional stimuli (as in S column), meaning that high neurotics showed less ERs as compared to low neurotics when treated with stable emotional stimuli.

Correlation of error scores in U and S column with neuroticism dimension of personality is given in Table 10

Table 10: Correlation of error scores in U and S column with Neuroticism dimension of personality.

Correlation of total U and S error score with total neuroticism		
	U	S
Neuroticism	0.68	-0.45

The above table shows correlation of total U and S error score with total neuroticism and the obtained value of U score with neuroticism is (r=0.68) positive and there is a high moderate relationship between the two factors whereas S error score shares a negative weak correlation [r= (-) 0.45] with neuroticism.

Regression analysis for prediction in U error score taking predictor as neuroticism is given in table 11.

Table 11: Regression analysis for prediction in U error score taking predictor as Neuroticism (N).

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig. .000	R SQUARE
		B	Std. Error	Beta			
1	(Constant)	-0.42	1.25		-0.34	.001	0.47
	N	0.65	.078	0.69	8.32	.001	

Dependent Variable: U SCORE

Predictor: (Constant), N

To predict U error score, Neuroticism dimension was used as a predictor in above table. This explains 47% of variation in U error score (dependent variable) attributed to Neuroticism [R square=0.470]. B value explains that one unit increase in neuroticism leads to 0.64 increase in U error score.

Regression analysis for prediction in S error score taking predictor as neuroticism is given in table 12.

Table 12: Regression analysis for prediction in S error score taking predictor as Neuroticism (N).

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	R
						.000	SQUARE
		B	Std. Error	Beta			
1	(Constant)	14.78	1.49		9.90	.001	0.21
	N	-0.42	.093	0.45	-4.44	.001	

Dependent Variable: S SCORE

Predictor: (Constant), N

In the same way, Neuroticism dimension was used as a predictor in above table. This explains 21% of variation in S error score (dependent variable) attributed to Neuroticism [R square=0.206]. B value explains that one unit increase in neuroticism leads to 0.42 decrease in S error score.

CHAPTER 6
DISCUSSION

The aim of the study was to find out the link between personality and selective attention through emotional go/no-go task. For the study, different pictures were selected, for emotion arousal, pertaining to high extraversion, low extraversion, high and low neuroticism characteristics.

The present hypotheses show that high extraverts will have more ERs with more emotionally arousing pictures (as in column E) as compared to low extraverts (H1). And high extraverts will have less ERs with less emotionally arousing pictures (as in I column) as compared to low extraverts (H2).

The pictures were selected that suited the high extraverts' characteristics and style in E column and low extraverts' characteristics in I column. The results obtained were consistent with the hypotheses. Results of t-tests: two sample assuming equal variances showed significant differences between high and low extraverts, as drastic differences are shown in ERs when treated with more emotionally arousing pictures in E column. This reports that extraverts showed higher ERs as compared to low extraverts when treated with more emotionally arousing pictures. Another test showed differences in ERs when treated with less emotionally arousing pictures in I column. This similarly depicted that high extraverts had less ERs as compared to low extraverts with less emotionally arousing pictures in I column.

Some previous studies had suggested that extraverts performed lowly on the anti-saccade task. In a study by Huogen N. Nguen, Jason B. Mingley, Larry A. Abel, found that extraverts made more errors more errors though there was no difference in latencies. Extraversion is indicated by sociability, a preference for physical activity and sometimes impulsivity. In prior studies, Eyesenck (1967) found that introverts' basal cortical arousal was higher than extraverts and that cognitive performance and arousal displayed an inverted U-shaped connection. Thus, introverts perform better than extraverts on tasks which are less arousing. Extraverts improve when there is high level of arousal. If reflexive saccade suppression and voluntary saccade initiation are more

challenging, extraverts make lesser errors and are faster. Introverts are high on monotonous tasks i.e they will perform better on low stimulating and routinized tasks.

Correlation was computed to see the degree of relationship between extraversion and E error score and similarly extraversion with I error score. The data revealed strong positive linear relationship with E score and a strong negative correlation with I score. This shows that higher the degree of extraversion more ERs are shown in E column and less ERs in column I.

It has been found by Mathews & Mackintosh (1998) that anxious individuals direct their attention towards danger-related material, in presence of competing neutral stimuli. There is great evidence that supports that anxiety is associated with increased distractibility and poor response inhibition.

Regression analysis was used to predict E and I error scores, taking predictor as Extraversion dimension of personality. Results revealed that extraversion as a predictor can predict more variation in E error scores than I error scores.

As extraverts being high on sociability, they are also high on impulsivity and anxiety. Extraversion is also associated with nature of psychopathology (Dinzeo & Docherty, 2007). High extraversion is related with low risk of psychosis and good quality life but poor work functioning with schizophrenic patients. In a study by Derryberry & Reed (1994), it was found that extraverts are slow when they have to shift their attention from positive places, while introverts are slow in shifting attention from negative ones. Fox, Russo, Bowles & Dutton (2001), found that high level anxiety individuals have problems in disengaging attention from threatening stimuli. It is believed that extraversion is marked by sociability and a preference for physical activity (Eyesenck, 1967) and sometimes impulsivity (Dopue & Collins, 1999). According to arousal theory of personality (H.J. Eyesenck, 1967), introverts have greater cortical arousal than extraverts and therefore, can perform at lesser levels of arousing stimuli. It was found that extraverts are prone to under arousal and there is slow performance decline during vigilance tasks. There is a close association and relationship between arousal and vigilance tasks (Koelegh, 1992).

The third hypothesis was that high neurotics will have more ERs with unstable emotional stimuli (as in U column) as compared to low neurotics. Another hypothesis was that high neurotics will have less ERs with stable emotional stimuli (as in S column) as compared to low neurotics.

The pictures were selected that suited the high neurotics' characteristics and style in U column and low neurotics' characteristics in S column. The results obtained were consistent with the hypotheses. Results of t-tests: two sample assuming equal variances showed significant differences between high and low neurotics, as drastic differences are shown in ERs when treated with unstable emotional stimuli in U column. This tells that high neurotics showed higher ERs as compared to low neurotics when treated with unstable emotional stimuli. Another test showed differences in ERs when treated stable emotional stimuli in S column. This similarly depicted that high neurotics had less ERs as compared to low neurotics with stable emotional stimuli in S column.

The evidence comes from studies by Watson and Clark (1992) that said that personality and attention are related and the emotional states influence not only what we attend to, but also how we attend to the world. In one study, it was shown that personality traits are linked with individual differences in eye movement's control. Issacowitz (2002) found that optimists had a fewer number of fixations on negative images than pessimists did. In addition, personality traits are related with the direction of the gaze but also with eye movement parameters beyond stimulus alterations. Rauthmann et. al (2012) found that individuals with more levels of neuroticism displayed extended fixation times and lesser number of fixations while extraversion was related with shorter fixation times and more number of fixations. Perman et al. (2009) had conducted an eye-tracking experiment, where different set of emotional facial expressions were used. Results of the study reported that neurotics spent greater time looking at the eyes of fearful faces. Eizenman et al. (2003) in a trait congruency model, supported the study, and said that people search for the information that is congruent to their personality traits

Correlation was computed to see the degree of relationship between neuroticism and U error score and similarly neuroticism with S error score. The data revealed high moderate positive linear relationship with U score and a weak negative correlation with S score. This shows that

higher the degree of neuroticism more ERs are shown in U column and less ERs in column S. The weak correlation in S column is due to the fact that there are certain ranges of instability; if people are not unstable it is not necessary that they would be high on stability.

Derakshan & Erikson, however, proposed that anxiety can have an influence on inhibitory control in absence of affect/emotion and danger-related stimuli. Dickman (1993), in proposals of impulsivity relates it to a greater propensity to shift attention through an area; this depends on higher activity in dopaminergic pathways. Avila, Barros, Ortet, Parcet & Ibanez, said that the response is greater in individuals with overactive BAS. In anxious individuals, this shifting ability is reversed when reward stimuli are detected (Avila, 1995; Derryberry & Reed, 1994).

Avila & Parcet found that impulsive individuals attended less to neutral spatial location and attended more to reward/expected targets. Regression analysis was used to predict U and S error scores, taking predictor as Neuroticism dimension of personality. Results revealed that Neuroticism as a predictor can predict more variation in U error scores than S error scores. The data revealed favored the U score, no prediction can be made of S error score i.e. Neuroticism can predict variations in unstable column more than stable column.

Derakshan et al (2009) reported that high anxious individuals had greater anti-saccade latencies than low anxious. The two groups, however, differ in ERs. No differences could be seen in pro-saccade task. This tells us that anxiety impairs inhibitory response to stimuli.

To sum up, this study describes the way we look at the environment and how we interpret it. It explains about the general personality traits we possess and how they affect our attention skills

6.1 Summary and conclusion

The present study highlights the role of eye movements in visual attention. The way people respond to their surroundings, depends upon his/her personality. Personality plays a significant role in visual attention. The purpose of the study was to compare high and low extraversion different set of emotionally arousing pictures. Similarly, the degrees of neuroticism were

compared with stable and unstable set of emotional stimuli. Results of the study indicated different personalities reacting differently to a set of emotional stimuli, prompting the suggestion for future research that the focus must be moved towards the role of personality in visual attention field.

Though various studies had been already done, on how personality plays a crucial role in visual attention. But the present research examines the role of affect in which personality gets influenced, and hence the eye movements. The study, mainly describes about personality as a crucial factor which influences person's attention towards any emotional stimuli.

6.2 Significance of the study

The role of eye movements in visual attention is of major interest to many researchers. How we move our eyes, where we look at is of significance in attentional paradigms. Personality and attention are interlinked as how we respond to the environment is truly dependent on who we are. There are few studies which study the effect of extraversion on emotionally arousing stimuli and their relationship and the effect of neuroticism on stable and unstable emotional stimuli. The study highlights the importance of eye movements with personality of an individual. We consider personality to be more stable determinant of human functioning. So it is crucial to study the relationship between personality and eye movements. Various researches on attention and personality have been conducted. However, no study so far has been conducted to see how personality affects the way we respond to emotional stimuli. No study by far has used emotional elements for go/no-go task to relate to personality dimension. The present study mainly talks about different degrees of extraversion and neuroticism, and how they respond to different set of stimuli favoring each one of them.

Extraverts being more active and impulsive might respond quickly and frequently to a stimuli that is attractive and arousing than the persons who are not extraverts. Introverts being more responsive to low emotion arousing stimuli will react less. In the same way, it's been found that people who are less stable they react more quickly to the stimuli favoring their characteristics. An anxious person's reaction to a stressful environment will be more intense than a person who

is low on anxiety. A person who is a pessimist will always respond to negative elements of a situation, disqualifying all the positives. Selective visual attention is of significance in visual field. It usually occurs without conscious awareness, and spontaneous reactions are formed which can be seen through eye movement tasks. People with high impulsivity may respond spontaneously to the more arousing stimuli. The go/no-go tasks require deliberate attention like top down processing of attention operates here. But pictures play a major role here because they lead to more automatic and less deliberate attempts without conscious awareness which leads to bottom up processing. People make errors while they attempt to look at pictures or move their eyes towards the stimuli that attract their eye. This study favors how the tasks that demand deliberate inhibition may be overruled if the stimuli in hand is arousing or matches the interest of person. The tasks demanding inhibition requires more awareness and consciousness than the tasks that are not inhibitory in nature. Therefore, the elements involved in tasks played a major role of automatic attraction, where the person has to control the impulse and deliberately direct attention towards the said direction or sometimes not to move the eyes. In this way, the study describe about individual differences where personality as a major factor can influence the person's attraction towards emotional stimuli.

6.3 Implications

The study is can be useful in many spheres. It is open to areas of employment, where people can be chosen for job profiles. There exists nature of personality, by which people respond differently to the different type of emotional stimuli. High extraverts are attracted towards high stimulating elements. This tells us how people at work respond to different kinds of activities that suit their interests. These inhibitory tasks can be used in military recruitment, where people can be trained to inhibit their SEM, whenever they see some luring stimuli. This can help in making them more inhibitory to an attractive stimuli that can divert their attention and therefore, increasing the chance of losses in combats. This allows increasing the concentration in an array of wide number of distracters. The study can be extended further to psychological and psychiatric illness where people with ADHD, Anxiety, OCD and other related disorders, may find difficulty inhibiting a particular response.

6.4 Limitations of the study and suggestions for future

There are a few limitations in the present scientific inquiry. The study would have been more effective with much standardized set of pictures. The study focused on normal population, so the error rates were not that prominent, as it would have been in case of population with some abnormality. The study would have been more valuable with special population like, if ADHD (Attention-deficit-hyperactivity disorder) or Depression population was chosen. It would have been made a remarkable discovery by comparing the personality types of normal and abnormal population. The scores of psychoticism could have been taken into account and the lie scores for further research. The traditional method was used in this study, like a video camera to capture eye movements. Instead of using a video camera, an eye tracker could have been used, which might provide more accurate responses. Apart from ERs, there could have been more variables like Saccade Reaction Times (SRTs), latency rates or gaze stability with the help of gaze maps.

The results could have been much better and reliable. Heckhausen and Heckhausen (2006) said that behavior is the outcome of interaction between personal tendencies like needs of personality traits and present situational conditions. These interact in complex ways. We can conduct studies to explore other variables than personality which can influence attention. More longitudinal, cross-cultural studies can be conducted. There are possibilities of extensive studies by controlling IQ and mental capabilities of subjects. Only the emotional element was covered in the study, ignoring the IQ factor which plays a significant role here. There are people who are less emotional but may be more at intellectual dimension and therefore, may not react to the stimuli. So, it is important to look into the factors that put major impacts on eye movements and attention. Individual differences also play a role here. The study is future oriented as it has proven a direct link between biology and personality aspects. How our eyes respond to environment is based on our personality. The study has a great future perspective. The overall personality can come into picture, where the scores of psychoticism dimension are considered. The study opens a wider area to calculate other variables like RTs (which are not considered here). This can tell about the impulsive individuals, and we can differentiate them from normal beings. There is also a scope of gender differences, as we can see how males and females differ on the preference over emotional pictures. The study has set a benchmark for future research and

innovations. The experimenter is looking forward to studying deeply with video game players and non video game players. Also, how the emotional stimuli used in go/no-go task is related with gender and whether there exists any difference between the two in choosing the different genres of video games, with the help of eye movements.

References

Abel, L.A., Douglas, J., 2007. Effects of age on latency and error generation in internally mediated saccades. Neurobiol. Aging28, 627–637.

Abel, L.A., Unverzagt, F., Yee, R.D., 2002. Effects of stimulus predictability and interstimulus gap on saccades inAlzheimer's disease. Dement. Geriatr. Cogn. Disord. 13,235–243.

Amador, N., Schlag-Rey, & Schlag, J. (2004). Primate antisaccade. II. Supplementary eye field neuronal activity predicts correct performance.Journal of Neurophysiology91, 1672–1689.

Ansari, T. L., & Derakshan, N. (2010). Anxiety impairs inhibitory control but not volitional action control.Cognitive & Emotion,24(2), 241–254.

Avila, C. (1995). Facilitation and inhibition of visual orienting as a function of personality. Personality and Individual Differences18, 503–509.

Avila, C. (2001). Distinguishing BIS-mediated and BAS-mediated disinhibition mechanisms: a comparison of disinhibition models of Gray and Patterson and Newman.Journal of Personality and Social Psychology,80, 311–324.

Avila, C., & Parcet, M. A. (2002a). Individual diferences in reward sensitivity and attentional focus. Personality and Individual Differences,33, 979–996.

Avila, C., & Parcet, M. A. (2002b). The role of attentional anterior network on threat-related attentional biases in anxiety.Personality and Individual Differences,32, 715–728.

Bar-Haim, Y., Lamy, D., Pergamin, L., Bakermans-Kranenburg, M. J., & van IJzen-doorn, M. H. (2007). Threat-related attentional bias in anxious and non-anxious individuals: A meta-analytic study.Psychological Bulletin,133, 1–24.

Bishop SJ (2007) Neurocognitive mechanisms of anxiety: An integrative account. Trends in Cognitive Sciences 11: 307–316

Bishop, S. J. (2009). Trait anxiety and impoverished prefrontal control of attention.Nature Neuroscience,12(1), 92–98.

Blanke O, Seeck M. Direction of saccadic and smooth eye movements induced by electrical stimulation of the human frontal eye field: effect of orbitalposition. Exp Brain Res 2003; 150:174–183.

Bojko, A., Kramer, A. F., & Peterson, M. S. (2004). Age equivalence in switch costs for pro-saccade and antisaccade tasks. Psychology and Aging, 19, 226–234.

Bredemeier, K., Berenbaum, H., Most, S. B., & Simons, D. J. (2011). Links between neuroticism, emotional distress, and disengaging attention: Evidence from a single-target RSVP task.Cognition and Emotion,25(8), 1510–1519.

Chen NTM, Clarke PJF, MacLeod C, Guastella AJ (2012) Biased attentional processing of positive stimuli in social anxiety disorder: An eye movement study. Cognitive Behaviour Therapy 41: 96–107.

Chou, I., Sommer, M.A., & Schiller, P.H. (1999). Express averaging saccades in monkeys.Vision Research, 39, 4200-4216.

Connolly, J. D., Goodale, M. A., Goltz, H. C., & Munoz, D. P. (2005). FMRI activation in the human frontal eye field is correlated with saccadic reaction time. Journal of Neurophysiology,94(1), 605–611.

Corbetta M, Shulman GL (2002) Control of goal-directed and stimulus-driven attention in the brain. Nature Reviews Neuroscience 3: 201–215.

Coren, S., & Hoenig, P. (1972). Effect of non-target stimuli on the length of voluntary saccades. Perceptual and Motor Skills, 34, 499-508.

Crawford, T. J., Higham, S., Renvoize, T., Patel, J., Dale, M., Suriya, A., & Tetley, S. (2005). Inhibitory control of saccadic eye movements and cognitive impairments in Alzheimer's disease. Biological Psychiatry, 57, 1052–1060.

De Lissnyder E, Derakshan N, De Raedt R, Koster EH (2011) Depressive symptoms and cognitive control in a mixed antisaccade task: specific effects of depressive rumination. Cognition & Emotion 25: 886–897.

Derakshan N, Ansari TL, Hansard M, Shoker L, Eysenck MW (2009) Anxiety, inhibition, efficiency, and effectiveness: An investigation using the antisaccade task. Experimental Psychology 56: 48–55

Derryberry, D., & Reed, M. A. (1994). Temperament and attention: orienting toward and away from positive and negative signals.Journal of Personality and Social Psychology,66, 1128–1139.

Derryberry, D., & Rothbart, M. K. (1997). Reactive and effortful processes in the organization of temperament.Development and Psychopathology,9, 633–652.

De Souza JFX, Menon RS, Everling S. Preparatory set associated with pro-saccades and anti-saccades in humans investigated with event-related fMRI.J Neurophysiol 2003; 89:1016–1023

Dickman, S. J. (1993). Impulsivity and information processing. In W. G. McCown, J. L. Johnson, & M. B. Shure(Eds.),The impulsive client: theory, research, and treatment. Washington, DC: American Psychological Association.

Dinzeo, T.J., Docherty, N.M., 2007. Normal personalitycharacteristics in schizophrenia: a review of the literatureinvolving the FFM. J. of Nerv. Ment. Dis. 195, 421–429.

Easterbrook, J. A. (1959). The effect of emotion on cueutilization and the organization of behavior.Psychological Review,66(3), 183–201.

Everling S, Fischer B (1998) The antisaccade: a review of basic research and clinical studies. Neuropsychologia 36: 885–899.

Eysenck, H. J. (1967).The biological basis of personalitySpringfield, IL: Thomas.

Eysenck, M. W. (1992).Anxiety: the cognitive perspective. Hillsdale, NJ: LEA.

Findlay, J.M. (1982). Global visual processing for saccadic eye movements. Vision Research, 22, 1033-1045.

Findlay, J.M., & Blythe, H.I. (2009). Saccade target selection: Do distractors affect saccade accuracy? Vision Research, 49, 1267-1274.

Fischer, B., & Weber, H. (1993). Express saccades and visual attention. Behavioral and Brain Sciences, 16,553-610.

Fox, E. (1994). Attentional bias in anxiety: a defective inhibition hypothesis.Cognition and Emotion,8, 165–195.

Gottlieb JP, Kusunoki M, Goldberg ME. 1998. The representation of visual salience in monkey parietal cortex. Nature 391(6666):481–4

Gray, J. A. (1981). A critique of Eysenck's theory of personality. In H. J. Eysenck (Ed.),A model of personality(pp. 246–276). New York: Springer.

Gray, J. A. (1994). Framework for a taxonomy of psychiatric disorder. In S. H. M. Van Goozen, N. E. Van de Poll, &J. A. Sergeant (Eds.),The emotions: essays on emotion theory(pp. 29–59). Hillsdale, NJ: LEA.

Heckhausen, J., and Heckhausen, H.(2006).Motivation und Handeln.Heidelberg: Springer.

Huang, L., & Pashler, H. (2002). Symmetry detection and visual attention:A “binary-map” hypothesis.Vision Research, 42,1421–1430.

Hutton SB, Ettinger U (2006) The antisaccade task as a research tool in psychopathology: A critical review. Psychophysiology 43: 302–313.

Isaacowitz, D. M. (2005). The gaze of the optimist.Personality and Social Psychology Bulletin,31(3),407–415.

Koelega, H. S. (1992). Extraversion and vigilance performance: 30 years of inconsistencies. Psychological Bulletin,112,239–258.

Kumari, V., ffytche, D.H., Williams, S.C.R., Gray, J.A., 2004.Personality predicts brain responses to cognitive demands.J. Neurosci. 24, 10636–10641.

Leigh RJ, Zee DS. The neurology of eye movements. 3rd ed. Oxford: Oxford University Press; 1999.

Lowe R, Guastella AJ, Chen NTM, Menzies RG, Packman A, et al. (2012) Avoidance of eye gaze by adults who stutter. Journal of Fluency Disorders 37: 263–274.

Mahlberg R, Steinacher B, Mackert A, Flechtner KM (2001) Basic parameters of saccadic eye movements–differences between unmedicated schizophrenia and affective disorder patients. European Archive of Psychiatry and Clinical Neuroscience 251: 205–210.

Mathews, A., & Mackintosh, B. (1998). A cognitive model of selective processing in anxiety. Cognitive Therapy and Research,22, 539–560.

Mogg K, Bradley BP (1998) A cognitive-motivational analysis of anxiety. Behaviour Research and Therapy 36: 809–848.

Miyake A, Friedman NP, Emerson MJ, Witzki AH, Howerter A, et al. (2000) The unity and diversity of executive functions and their contributions to complex "Frontal Lobe" tasks: a latent variable analysis. Cognitive Psychology 41: 49–100.

Munoz, D. P. & Corneil, B. D. Evidence for interactions between target selection and visual fixation for saccade generation in humans. Exp. Brain Res. 103, 168–173(1995)

Nieuwenhuis, S., Ridderinkhof, K. R., De Jong, R., Kok, A., & Van der Molen, M. W.(2000). Inhibitory inefficiency and failures ofintention activation: Age-related decline in the control of saccadic eye movements. Psychology and Aging, 15, 635–647.

Olincy, A., Ross, R. G., Young,D. A., & Freedman, R. (1997). Age diminishes performanceon an antisaccade movement task. Neurobiology of Aging, 18, 483–489.

Pashler, H. (1998).The psychology of attention.Cambridge, MA: MIT Press.

Pashler, H., & Harris, C. R. (2001). Spontaneous allocation of visual attention:Dominant role of uniqueness.Psychonomic Bulletin & Review, 8,747–752.

Perlman,S.B.,Morris,J.P.,Vander Wyk, B. C., Green, S. R., Doyle,J. L., and Pelphrey, K. A. (2009).Individual differences in personality predict how people look at faces.

Pierrot-Deseilligny, C. et al.Decisional role of the dorsolateral prefrontal cortex in ocular motor behaviour. Brain 126,1460–1473 (2003)

Pierrot-Deseilligny, C., Rivaud, S., Gaymard, B. & Agid, Y.Cortical control of reflexive visually-guided saccades. Brain114, 1473–1485 (1991).

Pishyar R, Harris LM, Menzies RG (2004) Attentional bias for words and faces in social anxiety. Anxiety Stress and Coping 17: 23–36.

Rauthmann, J. F., Seubert, C. T., Sachse, P., & Furtner,M. R. (2012). Eyes as windows to the soul: Gazing behavior is related to personality.Journal of Researchin Personality,46(2), 147–156.

See J, MacLeod C, Bridle R (2009) The reduction of anxiety vulnerability through the modification of attentional bias: A real-world study using a home-based cognitive bias modification procedure. Journal of Abnormal Psychology 118: 65–75.

Sweeney JA, Strojwas MH, Mann JJ, Thase ME (1998) Prefrontal and cerebellar abnormalities in major depression: evidence from oculomotor studies. Biological Psychiatry 43: 584–594.

Tamir M, Robinson MD (2007) The happy spotlight: positive mood and selective attention to rewarding information. Personality and Social Psychology Bulletin 33: 1124–1136.

Unsworth, N., Schrock, J. C., & Engle, R. W. (2004). Working memory capacity and the antisaccade task: Individual differences in voluntary saccade control. Journal of Experimental Psychology. Learning, Memory, and Cognition,30(6),1302–1321

Vitu, F. (2008). About the global effect and the critical role of retinal eccentricity: Implications for eye movements in reading. Journal of Eye Movement Research, 2 (3), 1-18.

Warner, C. B., Juola, J. F., & Koshino, H. (1990). Voluntary allocation versus automatic capture of visual attention.Perception & Psychophysics, 48,243–251

Watson,D., & Clark, L. A. (1992). Affects separableand inseparable: On the hierarchical arrangement of the negative affects.Journal of Personality and Social Psychology,62(3), 489–505.

Williams, I.M., Ponsford, J.L., Gibson, K.G., Mulhall, L., Abel, L.A.,1997. Saccadic control and cognitive function after traumaticbrain injury. J. Clin. Neurosci. 4, 186–196.

Williams M, MacLeod C, Watts F, Mathews A (1997) Cognitive Psychology and Emotional Disorders. London: Wiley.

Winograd-Gurvich C, Georgiou-Karistianis N, Fitzgerald PB, Millist L, White OB (2006) Ocular motor differences between melancholic and non-melancholic depression. Journal of Affective Disorders 93: 193–203.

Zelinsky, G. (1996). Using eye saccades to assess the selectivity of search movements.Vision Research, 36,2177–2187.

Zuckerman, M. (1987). A critical look at three arousal constructs in personality theories: Optimal levels of arousal, strength of the nervous system, and sensitivities to signals of reward and punishment.

APPENDICES

APPENDIX 1

Consent form

School of Psychology
THAPAR UNIVERSITY

RESEARCH INFORMED CONSENT FORM

Title of Project:		**Ethics Approval Number:**	
Investigator(s):		**Researcher Email:**	

Please read the following statements and, if you agree, initial the corresponding box to confirm agreement:

	Initials
I confirm that I have read and understand the information sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.	
I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason.	
I understand that my data will be treated confidentially and any publication resulting from this work will report only data that does **not** identify me.	
I freely agree to participate in this study.	

Signatures:

Name of participant (block capitals)	Date	Signature
Researcher (block capitals)	Date	Signature

APPENDIX 2

Eyesenck Personality Questionnaire Revised (EPQ-R)

EYSENCK'S PERSONALITY QUESTIONAIRE - REVISED (E.P.Q.-R)

Instructions: Please answer each question by putting (x) mark in the box following "Yes" or "No". There are no right or wrong answers or no trick questions. Work quickly and do not think too long about the exact meaning of the question.

PLEASE REMEMBER TO ANSWER EACH QUESTION

		*
1.	Do you have many different hobbies ?	Yes ☐ No ☐
2.	Do you stop to think things over before doing anything ?	Yes ☐ No ☐
3.	Does your mood often go up and down ?	Yes ☐ No ☐
4.	Have you ever taken the praise for something you knew someone else had really done ?	Yes ☐ No ☐
5.	Are you a talkative person ?	Yes ☐ No ☐
6.	Would being in debt worry you ?	Yes ☐ No ☐
7.	Do you ever feel "just miserable" for no reason ?	Yes ☐ No ☐
8.	Were you ever greedy by helping yourself to more than your share of anything ?	Yes ☐ No ☐
9.	Do you lock up your house carefully at night ?	Yes ☐ No ☐
10.	Are you rather lively ?	Yes ☐ No ☐
11.	Would it upset you a lot to see a child or an animal suffer ?	Yes ☐ No ☐
12.	Do you often worry about things you should not have done or said ?	Yes ☐ No ☐
13.	If you say you will do something, do you always keep your promise no matter how inconvenient it might be ?	Yes ☐ No ☐
14.	Can you usually let yourself go and enjoy yourself at a lively party ?	Yes ☐ No ☐
15.	Are you an irritable person ?	Yes ☐ No ☐
16.	Have you ever blamed someone for doing something you knew was really your fault ?	Yes ☐ No ☐
17.	Do you enjoy meeting new people ?	Yes ☐ No ☐
18.	Do you believe insurance schemes are a good idea ?	Yes ☐ No ☐
19.	Are your feelings easily hurt ?	Yes ☐ No ☐
20.	Are *all* your habits good and desirable ones ?	Yes ☐ No ☐
21.	Do you tend to keep in the background on social occasions ?	Yes ☐ No ☐
22.	Would you take drugs which may have strange or dangerous effects ?	Yes ☐ No ☐
23.	Do you often feel "fed up" ?	Yes ☐ No ☐
		*

P	E	N	L

(2)

*

24.	Have you ever taken anything (even a pin or a button) that belonged to someone else ?	Yes ☐ No ☐
25.	Do you like going out a lot ?	Yes ☐ No ☐
26.	Do you enjoy hurting people you love ?	Yes ☐ No ☐
27.	Are you often troubled about feelings of guilt ?	Yes ☐ No ☐
28.	Do you sometimes talk about things you know nothing about ?	Yes ☐ No ☐
29.	Do you prefer reading to meeting people ?	Yes ☐ No ☐
30.	Do you have enemies who want to harm you ?	Yes ☐ No ☐
31.	Would you call yourself a nervous person ?	Yes ☐ No ☐
32.	Do you have many friends ?	Yes ☐ No ☐
33.	Do you enjoy practical jokes that can sometimes really hurt people ?	Yes ☐ No ☐
34.	Are you a worrier ?	Yes ☐ No ☐
35.	As a child did you do as you were told immediately and without grumbling ?	Yes ☐ No ☐
36.	Would you call yourself happy-go-lucky ?	Yes ☐ No ☐
37.	Do good manners and cleanliness matter much to you ?	Yes ☐ No ☐
38.	Do you worry about awful things that might happen ?	Yes ☐ No ☐
39.	Have you ever broken or lost something belonging to someone else ?	Yes ☐ No ☐
40.	Do you usually take the initiative in making new friends ?	Yes ☐ No ☐
41.	Would you call yourself tense or "highly-strung" ?	Yes ☐ No ☐
42.	Are you mostly quiet when you are with other people ?	Yes ☐ No ☐
43.	Do you think marriage is old-fashioned and should be done away with ?	Yes ☐ No ☐
44.	Do you sometimes boast a little ?	Yes ☐ No ☐
45.	Can you easily get some life into a rather dull party ?	Yes ☐ No ☐
46.	Do people who drive carefully annoy you ?	Yes ☐ No ☐
47.	Do you worry about your health ?	Yes ☐ No ☐
48.	Have you ever said anything bad or nasty about anyone ?	Yes ☐ No ☐
49.	Do you like telling jokes and funny stories to your friends ?	Yes ☐ No ☐
50.	Do most things taste the same to you ?	Yes ☐ No ☐
51.	As a child were you ever cheeky to your parents ?	Yes ☐ No ☐
52.	Do you like mixing with people ?	Yes ☐ No ☐
53.	Does it worry you if you know there are mistakes in your work ?	Yes ☐ No ☐

*

P	E	N	L

(3)

		*
54.	Do you suffer from sleeplessness ?	Yes ☐ No ☐
55.	Do you always wash before a meal ?	Yes ☐ No ☐
56.	Do you nearly always have a "ready answer" when people talk to you ?	Yes ☐ No ☐
57.	Do you like to arrive at appointments in plenty of time ?	Yes ☐ No ☐
58.	Have you often felt listless and tired for no reason ?	Yes ☐ No ☐
59.	Have you ever cheated at a game ?	Yes ☐ No ☐
60.	Do you like doing things in which you have to act quickly ?	Yes ☐ No ☐
61.	Is (or was) your mother a good woman ?	Yes ☐ No ☐
62.	Do you often feel life is very dull ?	Yes ☐ No ☐
63.	Have you ever taken advantage of someone ?	Yes ☐ No ☐
64.	Do you often take on more activities than you have time for ?	Yes ☐ No ☐
65.	Are there several people who keep trying to avoid you ?	Yes ☐ No ☐
66.	Do you worry a lot about your looks ?	Yes ☐ No ☐
67.	Do you think people spend too much time safeguarding their future with savings and insurances ?	Yes ☐ No ☐
68.	Have you ever wished that you were dead ?	Yes ☐ No ☐
69.	Would you dodge paying taxes if you were sure you could never be found out ?	Yes ☐ No ☐
70.	Can you get a party going ?	Yes ☐ No ☐
71.	Do you try not to be rude to people ?	Yes ☐ No ☐
72.	Do you worry too long after an embarrassing experience ?	Yes ☐ No ☐
73.	Have you ever insisted on having your own way ?	Yes ☐ No ☐
74.	When you catch a train do you often arrive at the last minute ?	Yes ☐ No ☐
75.	Do you suffer from "nerves" ?	Yes ☐ No ☐
76.	Do your freindships breakup easily without it being your fault ?	Yes ☐ No ☐
77.	Do you often feel lonely ?	Yes ☐ No ☐
78.	Do you always practice what you preach ?	Yes ☐ No ☐
79.	Do you sometimes like teasing animals ?	Yes ☐ No ☐
80.	Are you easily hurt when people find fault with you or the work you do ?	Yes ☐ No ☐
81.	Have you ever been late for an appointment or work ?	Yes ☐ No ☐
82.	Do you like plenty of bustle and excitement around you ?	Yes ☐ No ☐
83.	Would you like other people to be afraid of you ?	Yes ☐ No ☐

P	E	N	L

*

(4) *

84.	Are you sometimes bubbling over with energy and sometimes very sluggish ?	Yes ☐ No ☐
85.	Do you sometimes put off until tomorrow what you ought to do today ?	Yes ☐ No ☐
86.	Do other people think of you as being very lively ?	Yes ☐ No ☐
87.	Do people tell you a lot of lies ?	Yes ☐ No ☐
88.	Are you touchy about something ?	Yes ☐ No ☐
89.	Are you always willing to admit it when you have made a mistake ?	Yes ☐ No ☐
90.	Would you feel very sorry for an animal caught in a trap ?	Yes ☐ No ☐

*

PLEASE CHECK THAT YOU HAVE ANSWERED ALL THE QUESTIONS

PAGE No.	P	N	E	L
1.				
2.				
3.				
4.				
TOTAL				

APPENDIX 3

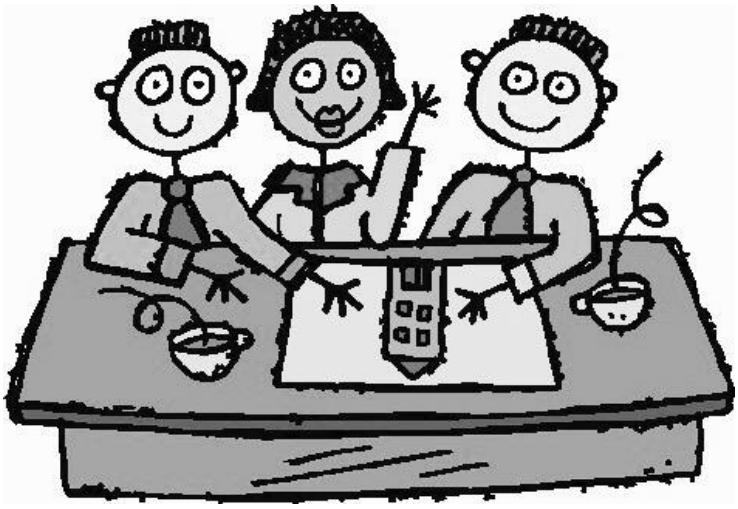
Pictures and emotional stimuli used

A3.1 Low emotionally arousing pictures (I1)

A3.2 Low emotionally arousing pictures (I2)

A3.3 Low emotionally arousing pictures (I3)

A3.4 High emotionally arousing pictures (E1)



A3.5 High emotionally arousing pictures (E2)

A3.6 High emotionally arousing pictures (E2)

A3.7 Stable emotional Stimuli (S1)

A3.8 Stable emotional Stimuli (S2)

A3.9 Stable emotional Stimuli (S3)

A3.10 Unstable emotional Stimuli (U1)

A3.11 Unstable emotional Stimuli (U2)

A3.12 Unstable emotional Stimuli (U3)