

## THE IMPACT OF ANXIETY AND GENDER ON PERCEIVING THE MUELLER-LYER ILLUSION

---

KHADER A. BAROUN AND BADER M. AL-ANSARI  
*Kuwait University, Kuwait*

This study aimed at investigating the relationship between anxiety, gender and the Mueller-Lyer illusion perception among a sample of 242 undergraduate students (66 males and 176 females), of Kuwait University, Kuwait, to the Mueller-Lyer and Horizontal-Vertical illusion forms. The subjects were divided into 3 groups (high, middle and low anxiety) in accordance with their anxiety scale scores. Although the overall analysis showed no significant difference between males and females with respect to most variables, a significant difference in anxiety was observed where females scored higher than males. The results also showed that gender had no significant correlation to the Mueller-Lyer perception and Horizontal-Vertical illusion. In addition, no significant difference was found as regards the anxiety and gender relationship to degree of illusion. However, the data did show some significant difference in relationship between anxiety and the perception of illusion, with males exhibiting higher scores for anxiety tending to have higher illusion error scores than males with low anxiety scores. Females with higher anxiety scores also were found to have higher illusion error scores than females with low anxiety scores.

Several studies have investigated the phenomenon that those who are high in anxiety trait have a bias effect in their interpretation of ambiguous stimuli and situations. Eysenck, Macleod, and Mathews (1987) suggested that high anxiety is associated with interpreting ambiguous stimuli in a threatening fashion. They also suggested that anxious participants concentrate their attention more on sites

---

Dr. Khader A. Baroun, Assistant Professor, and Dr. Bader Al-Ansari, Associate Professor, Department of Psychology, Faculty of Social Sciences, Kuwait University, Kuwait.

The efforts of Dr. Promila Sharma in the expert scientific editing of the manuscript are especially acknowledged

Appreciation is due to anonymous reviewers.

Keywords: anxiety, gender, Mueller-Lyer illusion perception, horizontal-vertical illusion forms, Kuwait University graduates, anxiety scales.

Please address correspondence and reprint requests to: Dr. Khader Baroun, Psychology Department, Faculty of Social Sciences, Kuwait University, P.O. Box 5659, Safat, 13060, Kuwait or to Dr. Bader Al-Ansari, Department of Psychology, Faculty of Social Sciences, Kuwait University, P.O. Box 5969 Safat, 13060, Kuwait. Phone: (965) 481-1188, Ext. 5206; Fax: (965) 484-6147; Email: <baderansari@Yahoo.com>

vacated by emotionally negative stimuli. The results of these studies, as a whole, showed that anxiety – though it is assumed to evoke – also has a negative memory bias, and should be assumed to have greater impact on basic levels of processing (Stuchlikova, 2000). Eysenck (1992) proposed that the hypervigilance of high anxiety individuals involves a high rate of environmental scanning, a broadening of attention prior to the detection of threat-related or task-relevant stimuli, and a narrowing of attention when such stimuli are being processed.

The literature does provide some support for the assumption that aroused anxiety facilitates an analytical mode of processing (Cunningham, 1988; Kuhl, 1983; Salovey & Rodin, 1985; Sedikides, 1992). There also are some inconsistent findings, such as the study by Cunningham and Ashley (2002), who examined the relationship of performance with intensity and direction of trait anxiety among students participating in a beginners' collegiate class of golf, and found the participants' scores to be dichotomized into those with negative perceptions of anxiety (debilitating interpreters) and those with positive perceptions (facilitating interpreters). As with attention orientation, habitual preferences for vigilance and cognitive avoidance are explained by the constructs of intolerance of uncertainty (vigilance) and intolerance of emotional arousal (avoidance).

Most research has indicated that anxious patients selectively attend to threatening stimuli. Reviewing available research in the field, Stewart, Conrod, Gignac and Pihl (1998) designed two studies to assess whether high Anxiety Sensitive (AS) subjects selectively process threat cues pertaining to the feared catastrophic consequences of anxiety, and to examine potential gender differences in selective processing of such threat cues among high versus low AS subjects. They found significant gender differences in the principal feared consequences for AS subjects, in that females with high AS scores selectively processed only physical threat cues relative to low AS females, and males with high scores of AS selectively processed only cues pertaining to social and psychological threat relative to low AS males. These differences among nonclinical high AS men and women were found to, respectively, resemble Mathews (1988) who reported that antinational bias towards threat may serve to maintain an anxiety state, because anxious individuals would be more likely to detect any potential source of danger in the environment.

Sinha and Sinha (1967) studied the effect of frustration on the extent of the Mueller-Lyer illusion of subjects scoring high and low on the anxiety scale. Their results revealed that the mean error of the magnitude of illusion for the low anxious group of subjects was greater than the mean error of the high anxious group of subjects. Thus, subjects scoring low on the anxiety scale were more susceptible to the Mueller-Lyer illusion than were those scoring high.

In a study examining anxiety-related bias in semantic activation when processing threatening or neutral homographs, Richards and French (1992) stated that high trait anxiety subjects were more likely to opt for the threat-related spelling compared to low-anxiety subjects. This general finding was also supported by the finding of Mathews, Richards, and Eysenck (1989), in a study comparing anxious patients with a group who had recovered from clinical anxiety.

Since this study was also concerned with gender differences in perception of ambiguous figures, it is necessary to review also some of the studies devoted to investigating the relationships between gender differences and perception of the Mueller-Lyer illusion. Shehab (2001) found significant gender differences between Kuwaiti boys and girls aged between 6 - 12 in perception of both Mueller-Lyer (Mueller-Lyer, 1889). and Horizontal-Vertical illusions. Boys exhibited higher illusion error scores than did girls. There are other studies, such as Stewart (1973), Faisse and Vautrey (1956) and Walters (1942), who found significant sex-related differences in the perception of the Mueller-Lyer illusion, indicating that boys were more susceptible to the Mueller-Lyer and the Horizontal-Vertical (HV) illusions from ages 6 to 13 except the 8 and 9 year-olds, while girls were more susceptible from age 14 to 18. It was also found that boys were more susceptible to the H-V illusion than were girls from age 6 to 19 years old. Shehab (1992) reported in another study that girls were more susceptible to the Mueller-Lyer illusion in a Scottish sample, and that boys were more susceptible to the Horizontal-Vertical illusion in a Kuwaiti sample.

Brosvic, Dihoff, and Fama (2002) studied age-related differences as transition points in the sensitivity and responsivity indices for the Horizontal-Vertical illusion on one- to three- year-old children. They found a significant age-related trend for each illusion through the inverse relation between sensitivity and responsivity. The youngest subjects had the lowest values on the sensitivity index and the highest values on the responsivity index, which the oldest subjects had the highest values on the sensitivity index and the lowest values on the responsivity index.

The present study aimed at investigating the relationship between anxiety, gender, and perception in cognitive attention, such as in the Mueller-Lyer illusion. Studies of high anxiety have revealed evidence that high anxious subjects have a lack of integration, attention and self-confidence generated by tension due to high anxiety. Thus, high anxiety can influence the perception of ambiguous stimuli, such as in the Mueller-Lyer illusion. The present study examines the association between anxiety and gender in perceptual judgments related to the processing of visual stimuli (the Mueller-Lyer illusion).

## METHOD

### SAMPLE

A total of 242 undergraduate students (66 male and 176 female) of Kuwait University constituted the study sample, and were selected from introductory classes. They received credit for their participation in an experiment described as a study of differences in perceptual processing. The mean age of the sample volunteers was 19.68 years with a *SD* of 1.69 years. Table 1 shows the description of subjects. Volunteers were asked to respond to the Kuwait University Anxiety Scale (Abdel-Khalek, 2000). The reliability scores on this scale ranged from .88 to .92 for coefficient alphas and test-retest correlations ranged from .70 to .93. The correlation factorial validity scores ranged from .14 to .75. The subjects were divided into three groups, upper, lower, and middle, according to the distribution of scores on the anxiety scale, to get the extreme of both low and high anxious subjects. The scores range for the anxiety scale was between 20 and 71. Subjects with scores of 53 and above were considered as having high anxiety ( $n=76$ ), and subjects with scores of 29 to 52 were considered as having medium anxiety ( $n=93$ ). Subjects with scores of 28 and below were considered as having low anxiety ( $n=73$ ). Table 2, shows the mean and *SD* of each of the three groups.

**TABLE 1**  
MEAN AND STANDARD DEVIATION OF SUBJECTS BY SEX AND AGE

Sex	N=242	AGE	
		<i>M</i>	<i>SD</i>
Male	66	19.96	1.68
Female	176	19.30	1.65
Total	242	19.68	1.69

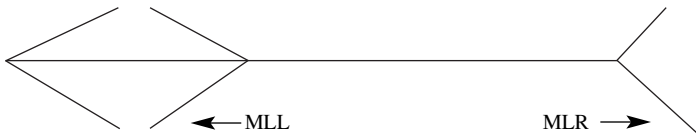
**TABLE 2**  
NUMBER, MEANS AND STANDARD DEVIATIONS OF ANXIETY

Groups Anxiety	N=242	<i>M</i>	<i>SD</i>
Low Score (28 and below)	73	25.37	2.19
Medium Score (29-52)	93	38.59	9.43
High Score (53 and above)	76	58.42	4.72

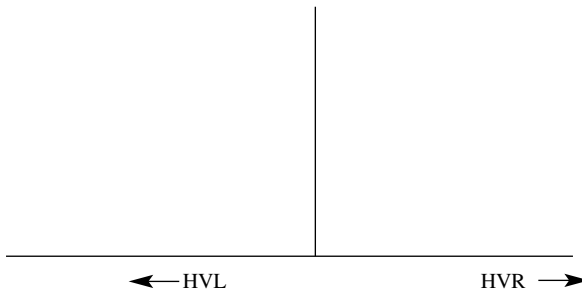
### MATERIAL

Mueller-Lyer and Horizontal-Vertical illusions were used to assess perceptual judgment in processing a visual stimulus. Both forms of the Mueller-Lyer (ML) illusion were represented on the same board; the one with the incoming left shaft (MLL) and the one with the outgoing right shaft (MLR). The T form of the Horizontal-Vertical (HV) illusion was also used in this study. The bisected line

was constant, while the other line was movable to the left side (HVL) and to the right side (HVR). The participant was asked to sit opposite the experimenter in the laboratory room, and to move the movable line until he/she felt that both lines (ML and HV illusion) were equal. Each subject was given only 10 trials for each side to minimize the practice effect. In half of the observations, the variable stimulus was on the subject's left side (MLL and HVL), and in the other half on the right side of the subject (HVR and HVR). In half of these sets, MLL, HVL, and MLR, HVR, the trials were given with the variable stimulus placement obviously too great so that the movement of the arrow would be inwards. In the other half, the variable stimulus was set obviously too small so that the movement was outward. Figure 1 shows the direction of MLL and MLR. Figure 2 shows the direction of HVL and HVR.



**Figure 1:** Brentano or combined form of the Mueller-Lyer illusion.



**Figure 2:** Brentano or combined form of the Horizontal-Vertical Mueller-Lyer illusion.

Anxiety was assessed on the basis of the Kuwait University Anxiety Scale, (Abdel-Khalek, 2000). The scale comprises 20 brief statements, on a 4-point scale, ranging from *rarely* (1) to *always* (4). Factor analysis yielded three high-loaded factors of Cognitive/Affective, Behavioral/Subjective, and Somatic/Anxiety, with moderate interfactor correlations, ranging from .27 to .74. Reliabilities ranged from .88 to .92 (alpha) and between .70 and .93 (test-retest),

denoting good internal consistency and stability. Criterion-related validity of the scale ranged between .70 and .88 (5 criteria), while the loadings of the scale, on a general factor of anxiety, were .93 and .95 in two-factor analyses.

## RESULTS

The *t*-tests were run to evaluate group differences on the ML and HV for all variables. The *t*-tests showed there were no significant differences between males and females in any of the variables except anxiety ( $t=50.96$ ,  $p>0.00$ ), females having higher mean scores ( $M= 43.08$ ) on the Anxiety Scale than did males ( $M=34.58$ ). The gender factor thus had no effect in the perception of the ML and HV illusion (Table 1). The mean, *SD* and *t* scores of males and females on six variables of the ML illusion, left (MLL), right (MLR), and HV illusion, left (HVL), right (HVR) and the Anxiety Scale are shown in Table 3.

**TABLE 3**  
MEANS, STANDARD DEVIATIONS AND *t*-SCORES OF MALES AND FEMALES BY SEVEN VARIABLES  
USING *t*-TEST

Variables	Gender	<i>n</i>	<i>M</i>	<i>SD</i>	<i>t</i>	Sig.
MLL	M	66	-125.41	91.42	1.31	NL
	F	176	-116.13	86.76		
MLR	M	66	-212.98	76.08	0.14	NL
	F	176	-196.65	77.68		
ML	M	66	-338.39	143.80	0.11	NL
	F	176	-312.74	138.95		
HVL	M	66	-32.27	127.09	1.68	NL
	F	176	-62.51	113.39		
HVR	M	66	-103.05	122.68	0.73	NL
	F	176	-129.26	109.49		
HV	M	66	-135.32	238.71	1.19	NL
	F	176	-191.76	211.51		
Anxiety	M	66	34.58	11.14	50.96	0.001
	F	176	43.08	15.18		

**Note:** MLL= Mueller-Lyer to Left  
MLR= Mueller-Lyer to Right  
ML = Mueller-Lyer as Total  
HVL= Horizontal-Vertical to Left  
HVR= Horizontal-Vertical to Right  
HV = Horizontal-Vertical as total

Although there were no significant relationships between anxiety and gender on ML and HV illusion perception, a close look at the data for the first half of the left (L) trials, and the other half of the right (R) trials of both illusions, using

ANOVA analyses of variance to evaluate group differences of the effect of anxiety and gender on perception of the six variables (ML, MLL and MLR, HV, left HVL and HVR), showed that there were some significant relationships between anxiety on perception of the illusion among both male and female subjects for left and right sides. There were significant differences on the variables MLL for the male sample; the mean error of magnitude of the illusion for the high-anxious group was greater than the mean of the low-anxious group ( $F=3.99$ ,  $p > 0.05$ ) and HVL ( $F=3.72$ ,  $p > 0.05$ ). This implied that males with a higher score of anxiety had a higher mean illusion error score (MLL  $m = -88.00$  mm,  $SD=79.9$  mm, HVL  $m = -147.00$  mm,  $SD=16.82$  mm) than males with a low anxiety (MLL  $m = -188.00$  mm,  $SD=79.96$ , HVL  $m = -147.00$  mm,  $SD =16.82$  mm) than males with low anxiety (MLL  $m = 121.98$  mm,  $SD=59.92$  mm, HVL  $m = -59.77$  mm,  $SD= 129.63$  mm). Table 4 shows the mean and  $SD$  of males for MLL and MVL.

**TABLE 4**  
MEANS AND STANDARD DEVIATIONS FOR MALES OF ML AND MVL

	Gender	Anxiety	<i>M</i>	<i>SD</i>	<i>F</i>	<i>P</i>
MLL	M	L	-121.98	59.97	3.99	0.05
		H	-188.00	79.96		
MVL	M	L	-59.77	129.63	3.22	0.05
		H	-147.00	16.82		

*Note:* MLL= Mueller-Lyer to the left

HVL =Horizontal-Vertical to the left

The data for female subjects also showed a significant relationship between anxiety and perception of the HVR, the mean error of magnitude of illusion for the high-anxious group ( $F=2.96$ ,  $p > 0.05$ ) and HVL ( $F=4.95$ ,  $p > 0.01$ ) illusion was greater than the mean of that low-anxious group. This meant that the females with a high anxiety score had a higher illusion error score (HVR  $m = -89.21$  mm,  $SD= 87.21$  mm, HVL  $m = -130.26$  mm,  $SD= 90.92$  mm), than did females with a low anxiety score (HVR  $m = -68.36$  mm,  $SD=116.66$  mm, HVL  $m = -96.71$  mm,  $SD=110.81$  mm). Table 5 shows the mean and  $SD$  of females for HVR and HVL.

**TABLE 5**  
MEANS AND STANDARD DEVIATIONS FOR FEMALES OF HVR AND HVL

Variables	Gender	Anxiety	<i>M</i>	<i>SD</i>	<i>F</i>	<i>P</i>
HVR	F	L	-68.36	116.66	2.96	0.05
		H	-89.21	105.38		
HVL	F	L	-96.17	110.8	4.95	0.05
		H	-130.26	90.92		

*Note:* HVR = Horizontal-Vertical to right

HVL =Horizontal-Vertical to left

## DISCUSSION

The results of this study indicate that there was no significant relationship between gender and the Mueller-Lyer and Horizontal-Vertical illusion perception. This means that males and females perceived the Mueller-Lyer and Horizontal-Vertical illusion (for left and right sides together) with no differences in illusion error scores. The nonsignificant differences found for the Mueller-Lyer and Horizontal-Vertical illusion (as a total) in this study could be explained in terms of the perspective theory. The ecological hypothesis of an open area assumes that people in an open area, like open fields or deserts (such as in the State of Kuwait), where the apparent distance extends in front of them, would be more susceptible to the Mueller-Lyer and Horizontal-Vertical illusion than others would be. However, this result is inconsistent with the results of Shehab's (2001) study, which showed significant gender differences between boys and girls (aged between 6 to 12 years old) on Mueller-Lyer and Horizontal-Vertical illusion perception. This inconsistency may be due to the fact that Shehab's study used a sample of children aged 6 to 12 years, whereas this study used graduate students.

The relationships between anxieties on the perception of illusion in this study were not clear. There were no significant differences between the groups with low and high anxiety in the perception of the Mueller-Lyer and Horizontal-Vertical illusions (as a total for both sides) respectively. However, there were some significant differences in anxiety on the other variables among males, such as MLL and HVL, and among females, HVR and HVL. The males with higher anxiety scores had higher mean error illusion on MLL and MVL (underestimation of the error of illusion). This implied that a male subject with high anxiety scores had a higher mean magnitude error of illusion on these variables than did a male with low anxiety. The results also showed that a female subject with high anxiety had a higher magnitude of illusion error score (underestimation of the error of illusion) of the HVR and HVL illusion than did the female with low anxiety scores. This finding is consistent with the results of the male data. The males with high anxiety had higher magnitude mean errors in the illusion; similarly, the females with high anxiety had higher mean errors in the illusion.

This finding is consistent with that of Sinha and Sinha (1967), who found that subjects with low scores of anxiety were more susceptible to illusion than those scoring high, and with that of Pandey, Roy, and Pandey (1986) who found an effect of frustration on the Mueller-Lyer illusion, using 30 low- and 30 high-anxious undergraduates, in that frustration enhanced the illusion in high – anxious subjects and reduced it in low – anxious subjects. The present finding is inconsistent with the finding of Stuchlikova (2000), who found that the magnitude of perceptual distortion was not closely related to trait anxiety. Therefore, increasing the level of anxiety for both males and females will

increase the error in perceiving Mueller-Lyer, on the other hand, decreasing the level of anxiety will decrease the error in perceiving Mueller-Lyer.

The findings of the present study could be explained by relationships of anxiety with the perception of the Mueller-Lyer and Horizontal-Vertical illusion in both males and females. Although the magnitude of perceptual illusion error scores was not closely related to trait anxiety on all variables, the visual tasks were used here to assess high and low anxiety and anxiety proneness was shown to influence perceptual learning. Highly anxious individuals seemed to need more rigidly tight criteria to judge or estimate the illusion. High anxiety is often held to foster an analytic mode of processing. Anxiety proneness may increase the tendency to use this type of processing whenever general ambiguity is increased. This explanation is consistent with that of Stuchlikova (2000). This difference can be also explained in terms of the lack of integration, attention and self-confidence on the part of the high-anxious subjects generated by tension due to high anxiety (Pandey, Roy, & Pandey, 1986).

Another explanation of these results is that participants with high anxiety may have some worry, self-doubts and experiences which result in procrastination and immobility in the face of possible failure. This explanation is supported by the findings of Thompson, Foreman, and Martin (2000) that participants with less satisfaction in their performance rated the success of their performance as low, expressed less confidence in their performance, reported greater negative affect, lower perceptual control, and reported greater anxiety both prior to and following the Stroop task (Stroop, 1935) on the State-Trait Anxiety Inventories 1 and 2 (STAI-1 and STAI-2) measures (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983), respectively. They also reported that imposters' anxiety is likely to be exacerbated in a situation characterized by many mistakes, in which imposters are particularly prone to overgeneralize a single mistake to mean total failure.

The present study indicated greater tendency to succeed in solving the problems posed by the ML and HV illusions at the level of differentiating processes for low-anxious individuals.

## REFERENCES

- Abdel-Khalek, A. (2000). The Kuwaiti Anxiety Scale psychometric properties. *Psychological Reports*, **87**, 478-492.
- Cunningham, M. R. (1988). What do you do when you're happy or blue? Mood, expectancies and behavioral interest. *Motivation and Emotion*, **12**, 309-331.
- Cunningham, G. B., & Ashley, F. B. (2002). Debilitative and facilitative perceptions of trait anxiety among students in a college golf class. *Perceptual and Motor Skills*, **94**, 739-742.
- Brosvic, G., Dihoff, R., & Fama, J. (2002). Age-related susceptibility to the Mueller-Lyer and the Horizontal-Vertical illusion. *Perceptual and Motor Skills*, **94**, 229-234.
- Eysenck, M. (1992). Cognitive factors in clinical psychology: Potential relevance to therapy. In M. Briley & S. E. File (Eds.), *New concepts in anxiety*. London: MacMillan.

- Eysenck, M. W., Macleod, C., & Mathews, A. (1987). Cognitive functioning and anxiety. *Psychological Research*, **49**, 189-195.
- Faisse, P., & Vautrey, P. (1956) The influence of age, sex, and specialized training on the Vertical-Horizontal illusion. *Quarterly Journal of Experimental Psychology*, **8**, 114-120.
- Kuhl, J. (1983). Emotion, kognition und motivation: L1. Die function bedeutung der emotionen fur das problemlosende denken und fur das konkrete handeln. *Sprache and Kognition*, **4**, 228-253.
- Mathews, A. (1988). Anxiety of the processing of threatening information. In V. Hamilton, G. Bower, & N. Frijda (Eds.), *Cognitive perspectives on emotion and motivation*. Dordrecht: Nijhoff.
- Mathews, A., Richards, & Eysenck, M. (1989). Interpretation of homophones related to threat in anxiety states. *Journal of Abnormal Psychology*, **98**, 31-34.
- Mueller-Lyer, F. C. (1889). *Dubloid-Reynolds Archive fur Anatomie und Physiologie* (supply), 263-270.
- Pandey, R. R., Roy, L. K., & Pandey, N. K. (1986). The effect of frustration on the extent of Mueller-Lyer illusion in high and low anxious subjects. *Indian Psychological Review*, **30** (2), 25-28.
- Richards, A., & French, C. (1992). An anxiety related bias in semantic activation when processing threat/neutral homographs. *Quarterly Journal of Experimental Psychology*, **45**, 501-525.
- Salovey, P., & Rodin, J. (1985). Cognitions about the self-connecting feeling states and social behavior. In P. Shaver. (Ed.), *Review of Personality and Social Psychology*, **6**, 143-166.
- Sedikides, C. (1992). Mood as a determinant of antinational focus. *Cognition and Emotion*, **6**, 129-148.
- Shehab, N. H. (1992). *Developmental and environmental factors in geometrical illusion*. Unpublished Ph.D. thesis, University of Stirling, Stirling, Scotland, U.K.
- Shehab, N. H. (2001). The effect of age and sex upon the Mueller-Lyer and Horizontal-Vertical illusion. *Arab Journal for the Humanities*, **19**, 289-300.
- Sinha, A. K., & Sinha, S. N. (1967). Mueller-Lyer illusion in subjects high and low in anxiety. *Perceptual and Motor Skills*, **24**, 194.
- Spielberger, C., Gorsuch, R., Lushene, R., Vagg, P., & Jacobs, G. (1983). *State-Trait Anxiety Inventory (STAI) for adults*. California: Consulting Psychologists' Press.
- Stewart, S., Conrod, P., Gignac, M. & Pihl, R. (1998). Selective processing biases in anxiety-sensitive men and women. *Cognition and Emotion*, **12** (1), 105-133.
- Stewart, V. M. (1973). Test of the carpentered world by race and environment in America and Zambia. *International Journal of Psychology*, **8**, 83-94.
- Stroop, J. R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology*, **18**, 643-662.
- Stuchlikova, Iva (2000). Trait anxiety and perceptual distortion. *Studia Psychologica*, **42** (1-2), 55-60.
- Thompson, T., Foreman, P., & Martin, F. (2000). Impostor fears and perfectionist concern over mistakes. *Personality and Individual Differences*, **29**, 629-647.
- Walters, A. (1942). A genetic study of geometrical-optical illusion. *Genetic Psychology Monographs*, **25**, 103-155,