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AGGRESSION: AN ORGANISMIC VARIABLE INFLUENCING PERCEPTION OF HORIZONTAL-VERTICAL LINES

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ABSTRACT

Most people when viewing horizontal-vertical lines of equal length, judge the vertical line as longer than the horizontal line. The relationship R = f(S) has been extensively studied in an attempt to explain the horizontal-vertical illusion (HVI). An adequate explanation has not been proposed. The present study approached the phenomenon of the illusion with the relationship R = f(O). The problem was to determine if aggressiveness was a significant factor in judgments of the HVI. The Edwards Personal Preference Schedule (EPPS) was used to define and measure aggression in forty students at Missouri Southern State College, Joplin, Missouri. The hypothesis was: There will be no significant difference between the horizontal-vertical illusion scores of aggressive and less aggressive persons. Eight students were randomly drawn from a subpopulation of aggressive persons and were defined as the aggressive group. Eight more students were randomly drawn from a subpopulation of less aggressive persons and defined as the less aggressive group. A students score was defined as the number of judgments made about the lengths of vertical and horizontal lines which did not conform to the actual physical lengths of the two lines. Judgments made about vertical and horizontal lines of equal length were not counted in scoring. The independent variable was the classification of students into aggressive and less aggressive groups. The dependent variable was judgments made about the lengths of two lines. It was found that the aggressive persons made significantly more wrong judgments on the

illusion than did less aggressive persons, $t(14) = 2.97$, $p < .02$. It was concluded that perception of the HVI is influenced by organismic variables and that previous studies fail to account for these factors in explanations concerning the HVI. Any adequate theory proposed to explain the illusion must include perceiver variables in its explanation.

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CHAPTER I

INTRODUCTION TO THE PROBLEM

Fick has been given credit for first calling attention to the discrepancy in horizontal and vertical judgments (Finger & Spelt, 1947). Most people, having viewed horizontal and vertical lines of equal length, judge the vertical line as longer than the horizontal line. Underwood (1966) discussed that an illusion represents a discrepancy between the real world and the world as the observer perceives it. There are two ways of observing an object or event. One is unaided by any instruments of measurement and represents the phenomenal measurements one makes when one judges the relative lengths of two lines such as the horizontal-vertical illusion or HVI. The other method of observation uses the aid of instruments to measure the objects or events along a physical scale. In order to speak of an illusion, there must be a consistent difference in phenomenal measurement and physical measurement.

The term "illusion" has varied connotations suggesting as it does that in some cases that the observer is unable to discriminate the actual physical properties of objects. When one is unable to do so correctly and instead gives a report that is not compatible with the physical arrangements of objects in space, it is said that one is experiencing an illusion (Graham, 1966; Kaufman, 1974). The fact that illusions are allowed to manifest themselves in perception suggests

that misinterpretation of reality might actually be of some positive benefit in the analysis of the visual world (Gregory & Gombrich, 1973). Obviously there is nothing wrong with the visual system and its corresponding nervous mechanism which "produces" the illusion. Both of them have to act according to the laws that govern their activity. Warren and Warren (1968) stated that the phenomenon is rather simply an illusion in the judgment of the material presented to the senses, resulting in a false idea of it. One reason why the material does not determine the percept is because the object affects the sense organ only by way of the proximal stimulus. But the proximal stimulus does not determine the final percept either, because two different proximal stimuli may produce the same receptor response (MacLeod & Pick, 1974).

Bruner and Goodman (1947) suggested that perception has been treated as though the perceiver were a passive recording instrument. To dismiss illusions as errors of judgment or mistaken interpretations seem to perpetuate the notion that all perceptions are correct. If by correct it is meant that the visual system gives a true representation of the physical events in the environment, then one must be prepared to place all visual phenomena in the category of illusion. An attempt to divide the problems of seeing into illusions and correct vision simply is not meaningful. What must be discovered is how the eyes and the perceiver operate under different circumstances. When this is fully understood, the process of visual perception will be understood, both with respect to

those facts and observations which seem intuitively obvious and straight forward, and those which, on the surface at least, seem puzzling and, therefore, are likely to be labeled mistakes.

Thurstone (1944) has stated that researchers frequently insist on the interdependence of all aspects of personality and that it would be difficult to maintain that perception is isolated from the rest of the dynamic system that constitutes the person. Postman, Bruner, and McGinnies (1947) suggested that perceptual selection depends not only upon the primary determinants of attention, but is also a servant of one's interests, needs, and values. Bruner and Postman (1948) have stressed the importance of need, personal value, stress, and tension as organizing factors in the perception of stimuli ranging from clearly present objects to ambiguous material. They suggested that material which is desired or fulfills a need tends to be emphasized in perception through magnification. Murray, et al. (1938) defined a need as "a construct (a convenient fiction or hypothetical concept) which stands for a force (the physico-chemical nature of which is unknown) in the brain region, a force which organizes perception, apperception, intellection, conation and action in such a way as to transform in a certain direction an existing, unsatisfying situation" (p. 124). Leibowitz (1965) has stressed that stimulation of a sense organ will not produce a fixed, mechanical, predictable perceptual experience, but that the final percept is subject to various transformations, alterations,

and expectations of the perceiver. During this process, the wants, needs, fears, and expectations of the observer modify and even distort to some degree what is finally perceived.

No longer are psychologists dealing with sensory data alone, but are now confronted with the many immeasurable intangibles included in the total personality. To some, this approach is confusing and sometimes unacceptable because in the demands for objective measurement one meets not only with the problem of meaning, the observer, and that which is observed, but also the relationships among these. All constitute essential areas of perception. Psychologists cannot ignore this phenomenological aspect simply because one has not succeeded in measuring it objectively. Some psychologists would tend to classify illusions as unreality and therefore not a proper object for psychological research. The lack of correspondence between sensation and stimulus adds to the complexity, but still it is this very factor which points so strongly to the role subjective influences play in the individuals perception of his own relation to reality.

Vernon (1966) has stated that "although attention and expectancy may arise from particular knowledge about certain aspects of the environment, they may also be related to the observers personal interests, abilities, and motives" (p. 331). Warren and Warren (1968) have stated that "one reason for the psychologist's interest in illusion can be found in the consideration of illusions as a kind of pathological perception" and that "there has been a continuing hope that illusions

would reveal the existence of normally hidden perceptual mechanisms" (p. 21).

Statement of the problem

The problem remains that the HVI phenomenon exists and no adequate theory has been proposed for its explanation. Various researchers have studied the illusion on the basis of R = f(S), i.e., response is a function of the stimulus, which does not take into account subject variables that may influence one's perception of the illusion. Any general theory of this phenomenon must account for perceiver variables as well as the visual mechanisms which contribute to the existence of the HVI.

Need for the study

A variety of theories have been proposed to explain the HVI phenomenon, none of which provides conclusive data, but all of which contribute to the significance of this kind of perceptual experience (Cohen, 1969a; Over, 1968). Clearly there exists a need to study the HVI with an approach that takes into account aspects of the perceiver that have been previously overlooked. Any theory concerning the HVI must include aspects of the perceiver, for it is the perceiver that responds to the stimulus.

Purpose of the study

This study was concerned with determining if aggression is a significant influencing factor in one's perception of the HVI.

Hypothesis

The hypothesis was: There will be no significant difference between the horizontal-vertical illusion scores of aggressive and less aggressive persons.

Definition of variables

The Edwards Personal Preference Schedule (EPPS) is a personality inventory which is intended to measure personality variables which are among the "needs" listed by Murray, et al. (1938) and Edwards (1959). One of these needs is aggression (Cohen, 1969b; Freeman, 1962; Gekoski, 1964). The EPPS aggression scale measures the following characteristics: "To attack contrary points of view, to tell others what one thinks about them, to criticize others publicly, to make fun of others, to tell others off when disagreeing with them, to get revenge for insults, to become angry, to blame others when things go wrong, to read newspaper accounts of violence" (Edwards, 1959, p. 12). Kaufmann (1970) states that "in order for behavior to be classified as aggressive, it must be transitive; that is, directed against a living target" and "the attacker must have an expectation or subjective probability greater than zero of reaching the object and of imparting a noxious stimulus to it, or both" (p. 9). The EPPS directs the person taking the inventory to choose those statements that he feels are characteristic of him. One can readily see the problem of defining and/or measuring aggression. For a detailed discussion of aggression, and the problems of

definition, the reader is referred to Kaufmann (1970). The aggression scale statements of the EPPS are presented in the Appendix.

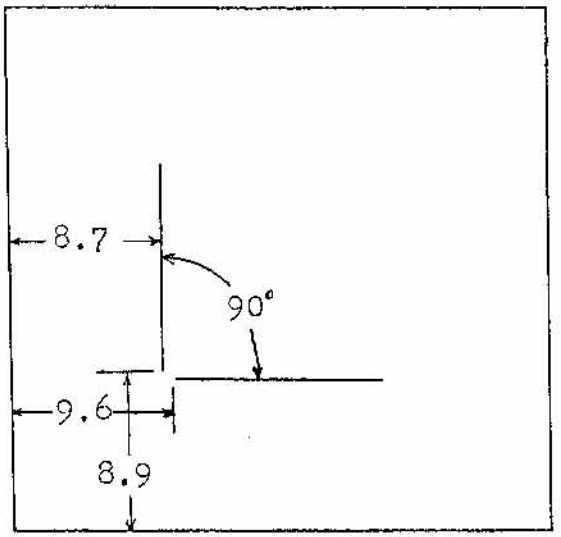
The EPPS was administered to forty students and a group mean of 43 percentile was computed from the aggression scale scores of the students. Aggressive persons were defined as those in the study who scored above the 43rd. percentile on the aggression scale of the EPPS. Less aggressive persons were defined as those in the study who scored lower than the 43rd. percentile on the aggression scale of the EPPS. The classification of aggression was defined as the independent variable.

The HVI was defined as green paperboard cards measuring 25.5 cm by 25.5 cm with a black horizontal line measuring 0.1 cm by 7.7 cm and a black vertical line measuring 0.1 cm in width and of various lengths drawn on the cards (see Figure 1, page 8).

Wrong judgments were defined as a persons total number of errors in judging the lengths of two lines, with the exception that judgments made about lines of equal length were not counted in the score. Judgments were defined as the dependent variable.

Delimitations of the study

In a systematic observation study, no independent variable is produced or purposely manipulated. This study was concerned with the relationship R = f(O), i.e., a response



Card No.	Vertical	Horizontal
1	8.0	7.7
2	7.8	7.7
3	7.7	7.7
4	7.5	7.7
5	7.3	7.7

Figure 1. Position and Length (in cm) of Lines on Cards.

class is a function of (a class of) organismic variables. The level of aggression already existed in the population and was classified into two groups for study. The independent variable of aggression was the only subject variable studied. The population sample was randomly drawn from students attending Missouri Southern State College, Joplin, Missouri. Variables of visual acuity, place, and presentation of the HVI were held constant for the final participants in the study.

Limitations of the study

Psychological variables other than aggression were assumed to exert equal effects randomly. Edwards (1959) reports that the raw score distribution on the EPPS norm group for both college men and women are fairly symmetrical about their respective means, but percentile norms were established for both college men and women on each scale. The percentile corresponding to a given score is a measure of the score's relative position in the complete distribution of scores for the normative group. The EPPS makes no attempt to define precisely just what constitutes aggressive individuals. The author of the EPPS leaves this decision to each user of the inventory. Aggression was operationally defined for the purpose of this study.

Time of day was not controlled since one group was tested on one day and the other group was tested the following day.

CHAPTER II

REVIEW OF THE LITERATURE

Orientation and line bisection studies

Most people, when viewing vertical and horizontal lines together, judge the vertical line as longer than the horizontal line even though both lines are of equal length. This phenomenon has been referred to as the horizontal-vertical illusion or HVI. Finger and Spelt (1947) studied the effects of the division of the horizontal line by the vertical line in an inverted T figure of the HVI, with the assumption that this condition was a factor in faulty perception of the lengths of the lines. They compared four figures: (1) the L form, with the lines slightly seperated; (2) the same L rotated clockwise through 90 degrees; (3) the inverted T; and (4) the inverted T rotated clockwise through 90 degrees. Their apparatus was so constructed that the subject could adjust the variable line in comparison to the fixed standard line. Between judgments, subjects were asked to close their eyes while the experimenter recorded measurements and readjusted the variable line. Forty trials were given to each of seventy-two subjects. Results confirmed the assumption that perception of the inverted T is in part, a function of line bisection. However, exceptions to the expectations of the experimenters were present and the authors stated that the responses of subjects were determined by more than the factors with which the study was concerned and suggested that subject

attitude and time allowed for responding are relevant parameters.

Kunnapas (1955a) studied several positions of the ⊤ figure of the HVI in an attempt to explain the effect of overestimation of the dividing line on the illusion. Stimuli materials consisted of white cardboard squares upon which were drawn the ⊤ form in four different positions. The horizontal divided line was 50 mm in length, while the vertical dividing line varied from 35 mm to 64 mm in intervals of 1 mm. The width of the lines was .3 mm. The vertical dividing line intersected the horizontal divided line at nine different points. The last two intersection points resulted in the ⊥ figure of the illusion. Ten subjects viewed the cards at a distance of 100 cm. Subjects had to compare and report whether the dividing line was shorter, equal to, or longer than the divided line. Five seconds time was allowed for each judgment and when no judgment was made within five seconds a response of equal was recorded. The principle findings were that in the HVI two different illusions appeared. One, the regular HVI and two, an illusion based on overestimation of the dividing line. This difference was attributed by Kunnapas to the effect of an additional factor in the ⊥ form, namely the intersection of the two lines, the divided line appearing as shorter than the divider. The magnitude of the illusion also varied with the age of the subject.

Begelman and Steinfeld (1967) experimenting with the HVI, varied the length of the standard line, degrees of lateral

separation of horizontal and vertical stimuli, and which line served as the standard. Results showed that when judgments were averaged under horizontal and vertical standard conditions, a negative relationship existed between the magnitude of the illusion and the length of the standard line. When the vertical line was used as the standard, the illusion increased as a function of lateral separation of the stimuli, but decreased with horizontal as the standard line. These differential trends contributed to the unsystematic relationship between the size of the illusion and the progressive displacement of the horizontal and vertical lines. The authors suggested that the findings are not compatible with previous explanations of the HVI involving an error in judgment of the standard line.

Avery (1970) conducted three experiments to test the hypothesis that the magnitude of the HVI in an L figure varies as a function of which line is used as the standard. Using fourteen subjects in the first experiment, results showed that no significant differences were found by varying the component used as the standard. In the second experiment with fourteen subjects, using a method of adjustment, the magnitude of illusion was effected by the component used as standard. Subjects in the third experiment made their judgments in the upright and recumbent body postures and results supported the conclusion of experiment one. Overall, Avery concluded that earlier differences associated with the standard are a methodological accompaniment of the psychophysical technique used.

Becker (1972) studied the effects of division and orientation on the HVI. One-hundred subjects viewed a HVI board that was manufactured by the Lafayette Instrument Company. Two groups, of fifty subjects each, viewed the illusion. The control group viewed the illusion and were asked to adjust the horizontal line segment so that it appeared equal to the vertical line segment. The experimental group was asked to do the same, but in addition were to make their adjustments more accurate by cognitive instructions as to how to look at and interpret the stimuli. The instructions were to look at the vertical line and by the use of imagination extend the horizontal line through the vertical line, thereby dividing it into equal segments, then to extend the horizontal line until it appeared equal to one-half the vertical line, and to extend the horizontal line further until it was equal to the vertical line. Results indicated that the HVI was reduced when division and orientation were used in making adjustment judgments of equality, thereby permitting more accurate discriminations. However, the author noted that the illusory effect was not eliminated.

Teghtsoonian (1972) investigated the HVI to determine the viability of the error-of-standard characteristic. Twenty-two female subjects drew four lines matched to each of six standard lengths ranging from 4 mm to 100 mm. Results showed that even when the standard was in the same orientation as the drawn line, the drawn length was not identical with, nor linearly related to the presented standard line length. In a

second experiment, subject bias was discounted for twelve subjects and this resulted in the HVI having the same strength regardless of orientation to the standard. Overall, it was concluded that the error-of-standard in experiments on the HVI has nothing to do with the standard or its orientation, but is an error of adjustment, resulting when a subject must adjust one stimulus to match a standard stimulus.

Wober (1972) experimented with the illusion in an attempt to find if the illusion was stronger when presented as a contrast between a vertical line with a horizontal line at its bottom or when a vertical line had a horizontal line at the top. Sixteen adults viewed horizontal-vertical stimuli in those positions. Wober concluded that no significant differences existed between low-horizontal and high-horizontal illusions.

Cormack and Cormack (1974) studied the effects of mirror images of the L and side T forms of the HVI and the effects of tilts of the upright on the + and ⊥ forms of the illusion. Six stimuli configurations were used (L, ⊣, ⊥, +, ⊥, ⊢). Seven angular variations of the standard vertical line were used in each figure forming forty-two stimuli figures. Nineteen females and twenty-one males served as subjects. Each subject was tested individually and was allowed unlimited adjustments of the horizontal line until satisfied that the lines were equal in length. All subjects were given twenty-eight trials each. Because the experimenters were interested in right-left asymmetry in symmetric figures,

twenty subjects observed the asymmetric figures with the left line being standard and the remaining observed the same figures with the standard on the right. Results showed that the degree of tilt was significant for both the ⊤ and ⊥ forms. Direction of tilt was not significant. In all figures the HVI was in effect, but lesser with the vertical standard at a 90 degree angle from the horizontal and greater with small angle deviations from the vertical.

Harris, Hayes, and Gleason (1974) conducted two experiments to examine the relative role of bisection and vertically to the inverted ⊤ variant of the HVI. In experiment one using binocular presentation of the stimuli, results indicated that the magnitude of the illusion could be accounted for by simple additive combinations of the magnitude of the vertical and bisection subillusions. Experiment two replicated the findings using dichoptic presentation, that being a horizontal line to one eye and a vertical line to the other eye. Results of the study indicated that the amount of the HVI is due to the separate factors of bisection and vertically, and that these processes are cortical rather than peripheral in origin.

Schiffman and Thompson (1975) examined the role of figure orientation directly, and the role of an inappropriately invoked size-constancy mechanism indirectly in the actuation and magnitude of the HVI. Results showed that when the vertical line was aligned above the horizontal line, the illusory effect was significant and a positive illusion existed (the vertical line was judged longer than the horizontal line).

When the vertical line was aligned below the horizontal line, the illusion was negative (the vertical line was judged shorter than the horizontal line). From the results, the authors suggested that a vertical line could appear as a foreshortened line in depth and therefore, their findings supported an explanation based on the operation of a misapplied size-constancy mechanism.

Frame and visual field studies

Kunnapas (1955b) investigated the influence of frame size on judgments of length of a line within a frame. White square pieces of cardboard of various sizes were used as frames. In the center of the frames, a line was drawn which varied in length with each frame. A frame with a 50 cm line on it served as the constant stimulus. Ten subjects compared the length of two exposed lines in two frames (one of which was the constant stimulus), and made a judgment as to whether the variable line was shorter, equal to, or longer than the constant line. Order of presentation and position of the two frames were varied to equate possible learning and fatigue effects. Each subject made a total of eighty judgments. Results indicated that frame size greatly influences the judged length of a line within a frame. Kunnapas concluded that the frame influences the apparent length of not only horizontal, but also probably vertical lines as well.

Kunnapas (1957) used an L form to study the effects of visual field on the HVI. Kunnapas hypothesized that the

vertical lengths were overestimated because the visual field of the eyes has the form of an ellipse that is extended in the horizontal direction and that viewing the HVI in a dark situation would reduce the illusion. The apparatus used consisted of a circular white surface on which two luminous lines could be seen through two slits, .5 mm wide. The vertical line was constructed in a manner that it could be variable in length. Ten subjects viewed the stimuli in a lighted situation in which the room was illuminated and ten other subjects viewed the stimuli in a dark situation in which the room was dark except for the two luminous stimuli lines. Results showed a decrease in overestimation of the vertical line in the dark situation, but the illusion was not eliminated.

Avery and Day (1969) conducted three experiments to determine a basis of the HVI. Experiment one was to determine the magnitude of the HVI under different conditions of room light. Fourteen subjects were used with all subjects viewing the HVI under conditions of darkness, dimness, and lighted room presentations. The subjects viewed the stimuli from a distance of 65 cm and were instructed to close their eyes between judgments of the length of the vertical line relative to the horizontal line. The vertical and horizontal lines were constructed so that the vertical line could be varied in length and the horizontal line held constant. It was found that no significant differences existed between the mean points of subjective equality in all three lumination conditions. The authors concluded from experiment one that

eliminating and obscuring the visual field did not eliminate or reduce the HVI, but that under conditions of darkness the illusion is greater than under lighted conditions. Experiment two was concerned with the magnitude of the illusion without a defined visual field, and head position in the upright and horizontal positions. Fourteen subjects were divided into two groups. One group viewed the stimuli in the upright and the other viewed the stimuli in a recumbent position in an otherwise dark room. Results indicated that a line falling on a particular meridian of the eye is apparently perceived longer than one of the same length that is at right angles to it. Experiment three was concerned with tilting the ⌊ form of the illusion in 15 degree increments to 90 degrees, to determine if the illusion would change from positive to negative. Seven groups of fourteen subjects to each group were used for seven angles of tilt. The vertical line was pointed out to subjects because as the angle of tilt increased, the original vertical line became horizontal in position. Results showed that as the degree of tilt increased, the illusion went from positive to negative. The authors concluded that in the ⌊ form, the illusion is determined by the orientation of the retinal image. A line which falls on the vertical retinal meridian will appear longer than an equal line which falls on the horizontal retinal meridian. Avery and Day pointed out that this anisotropy is probably a function of retinal directions rather than directions relative to an external reference.

Thompson and Schiffman (1974) examined the effects of display size (frame size) and figure orientation on the HVI. According to the visual field hypothesis, the authors suggested that if the relation of the figure components to the surrounding frame is held invariant, neither experimental manipulations would exert significant influence on the illusion. Results showed that both display size and figure orientation produced significant influence, indicating that the visual field hypothesis is not sufficient as the primary determinant of the HVI.

Exposure time, tracking, and retinal studies

Schiller and Wiener (1962) using exposure time, binocular and stereoscopic viewing of the HVI as variables, tested five subject's perception of the illusion. The subjects were instructed to state whether the vertical line appeared longer or shorter than the horizontal line. The results showed that almost no change over viewing conditions was found for the HVI. However, the illusory effect was the smallest with stereoscopic presentation, with a long exposure time. There was little or no decrement with short time stereoscopic presentation. The authors suggest that illusory effects can be attributed primarily to central factors.

Landauer, Rhine, and Rumiz (1968) studied tracking movements of forty-eight subjects when a dot of light was presented in the horizontal-vertical plane under open viewing conditions, but without being able to monitor their tracking

drawings. The authors wanted to determine if vertical movement was overestimated such as it was in the HVI. Results indicated that the vertical movement components were significantly overestimated, both when subjects tracked in the upright or level plane. The authors suggested that these results are a manifestation of the HVI.

Pearce and Matin (1969) maintained that the flattening of the peripheral zones of the refracting surfaces of the eye may be involved in the variation of the HVI with retinal position, and that the astigmatic properties of the central portions of these surfaces may be a prime factor in the visual HVI.

Avery and Day (1971) studied the horizontal-vertical velocity illusion in which an object moving vertically seems to move faster than one moving horizontally at the same speed. The authors used a stimulus display which consisted of a lighted L figure and two points of light moving in paths parallel to the two lines and which was viewed in a darkened room. Results indicated that the direction of movement in each orientation was not a significant variable. There was no significant effect due to the movement orientation used as the standard. The illusion persisted when horizontal and vertical paths were equated for apparent length. It was found that different functions for the length and velocity illusions occurred as the separation and overlap of motion paths were varied. The velocity illusion did not occur when subjects were recumbent. Overall, the results were interpreted as

showing that the horizontal-vertical velocity illusion was not secondary to the HVI, but has independent determinants.

Begelman and Steinfeld (1971) studied the influence of retinal determinants on the HVI by varying the size of the stimuli and varying the subject's distance from the stimuli. In this manner, the experimenters were able to control the phenomenal and retinal size of the stimuli. Thirty-two subjects were used with each subject viewing the stimuli under eight different conditions. The subjects wore dark sunglasses to reduce the presence of any clues that might have influenced their judgments. Results showed that a greater illusion was obtained when vertical was compared with horizontal and that a greater illusion was obtained with an 18 inch distance condition as compared to a 9 inch distance condition. The authors stated that the HVI is effected by retinal factors, but its explanation is still uncertain.

Schiffman and Thompson (1974) conducted an experiment to determine if eye movements effected the magnitude of the HVI. Eye movement was eliminated by presenting small figures tachistoscopically. The results showed that eye movements did not play a major role in the production of the HVI, but may exert a secondary effect.

Developmental and tactual studies

Bean (1938) studied visual illusion patterns using twenty-eight blind persons and twenty-eight blindfolded sighted persons. The patterns were large enough to require

active exploration by the subjects. It was found that those who experienced the HVI, went from end to end of the horizontal line with their fingers, but did not go to the top of the vertical line. The illusion was greater in the L form. The illusion was experienced by twenty-two blind and three sighted subjects. It was found that brighter subjects experienced more illusion. Bean found that the older the person, the more illusion he experienced, and that the better one's school work, the more illusion one experienced. Bean suggested that perceptual efficiency is the result of long intelligent habit forming experiences and that oculomotor theories do not explain sufficiently the illusory phenomena in those who can and can not see.

Doyle (1967) studied the independence of CA and MA to determine if perceptual and intellectual development were independent. The HVI was used as the stimulus for the sense modalities of sight, hearing, and touch. One-hundred and eight children were assigned to one of eighteen groups. Six subjects comprised the groups of various combinations of sex and MA (7, 9, 11 years). The subjects judged whether the horizontal stimulus was greater than the vertical stimulus in each sense modality. Results indicated that the HVI was reliably effected by MA, but so was it for CA. As MA increased, the lesser the illusion, and as CA increased, the lesser the illusion. No significant sex differences were found. It was found that retarded subjects in the CA, 11 year group, were more accurate in their judgments than the younger MA

groups. Doyle suggested that perceptual development may progress despite the restrictions of limited intelligence. She stated that retarded children may be helped to learn by using various sense modalities. Doyle concluded that accuracy in perceptual judgments is not soley a function of intellectual development.

Tedford and Tudor (1969) examined the HVI and the continuous-broken line illusion to demonstrate that both illusions were present in tactual and visual perception. They compared the illusions magnitude using different sense modalities. One-hundred subjects were used in which fifty were tested in the tactual mode and fifty were tested in the visual mode of perception. Each subject received forty-two trials and judged whether the continuous line or the broken line was longer in an inverted ⊤ figure and a ⊤ figure placed sideways to the right. No judgments of equality were allowed. Results indicated no significant sex differences, but females were more susceptible to the tactual illusions than males. The visual illusions were greater than the tactual illusions, but fell off as the comparison line increased in length. The authors suggested that the body has its own standard for judging distance and that possibly the cause of the HVI in visual perception is a result of early developmental experience with tactual perception.

Day and Avery (1970) studied the HVI using the haptic sense. They predicted that an overestimation of vertical length would not occur in the haptic sense using the ⌊ form.

Included in the study was the ⊥ form for comparison. Eight men and six women were blindfolded and required to move their index finger of their preferred hand over the edge of a raised figure and judge whether the vertical was longer or shorter than the horizontal. All the subjects made judgments of both figures. Results tended to support their prediction in that a haptic illusion occurred with the ⊥ form, but not with the L form. The authors concluded that the inverted T illusion was due to bisection of the figure since the L form was not bisected.

Fry and Craven (1972) studied the developmental trend and the relationship between sense modalities of perception of the HVI. The performance of forty boys was compared with the performance of twenty college males. Cards which had an inverted T figure inked on them were used for the visual stimuli. Plastic rods placed in the L form were used for the actively tactual stimuli. The subjects were instructed to run their preferred index finger once along the length of one rod and then once along the length of the other rod. The experimenters guided the subjects hand to a starting point on the horizontal and vertical rods. A template was used to draw the inverted T lines on the subjects preferred palm for the passively tactual stimuli. All vertical lines were variable in one-eighth inch increments. Results showed that the passive stimuli evoked the greatest positive illusion and the visual stimuli the greatest negative illusion. The active stimuli evoked the least negative illusion. Age was found

not to be a factor in perception of the illusion, indicating no developmental trend. However, a significant difference was found between active and passive stimuli presentation in children.

Wong (1975) examined the developmental trend of the tactile HVI using the ⌊ form and the volar surface of the forearm as the receptor site. Wong compared data obtained from four groups of twenty subjects each and data from a fifth group of twelve subjects from a previous experiment containing the same conditions. He found that no sex differences existed within groups and that the tactual HVI in the ⌊ and ⊤ versions were present among both children and adults. No developmental trend was found in the study.

Cultural and environmental studies

Segall, Campbell, and Herskovits (1963) in a rather comprehensive study of various geometric illusions used two versions of the HVI to test the influence of culture on perception. They found that non-western scores were significantly higher on the HVI and that data supported the hypothesis that plains dwellers would prove maximally susceptible, with urban dwellers moderately so, and groups in restricted environments such as equatorial forests minimally susceptible to the HVI.

Deregowski (1967) experimented with Lusaka school boys perception of the HVI and concluded that if a carpentered environment actually played a role in producing the illusion,

a cruciform or L form figure is the only method to measure the illusory effect.

Dawson, Young, and Choi (1973) using various illusion producing geometric designs, tested the cross-cultural developmental theory relating to changes in illusion susceptibility with age. Data from the Muller-Lyer and Sander-Parallelogram illusions confirmed the expected decrease in three to twelve-year-olds due to exposure to a more sophisticated environment. The data supported the hypothesis regarding contiguous and noncontiguous versions of the HVI. The results supported the urban verses open area differences in habit of perceptual inference.

Jones (1974) investigated differing ecologies effects on illusions and tested the hypothesis that people living in open places would be more susceptible to the HVI than persons living in urban areas. Results showed that persons living in open areas were more susceptible to the HVI.

Summary of the literature

Studies indicate that many factors have an influencing role in perception of the HVI. Some studies show conflicting results. There is a strong suggestion that the HVI is due to retinal meridians, but this suggestion does not explain differences obtained between persons who apparently have the same visual mechanisms, yet differ in the perception of the illusion. Also, when the HVI was tilted and misaligned with the retinal meridians, the illusion persisted. Variables such

as figure design, rotation of figure, and method of presentation have been studied, although little has been researched concerning the perceiver who views the HVI. Cultural differences have been found and may be a result of long intelligent habit forming experience as suggested by Bean (1938). Doyle (1967) has reported some evidence that intelligence influences perception of the illusion, and Finger and Spelt (1947) suggested that attitude may be an influencing variable. One can conclude from the research concerning the HVI that perceiver variables have not been given proper attention. This situation is rather precarious since perception depends upon a perceiver. Theories concerning the perception of the HVI must account for perceiver variables if an adequate explanation of the phenomenon is to be presented.

CHAPTER III

METHOD

Subjects

The population consisted of students at Missouri Southern State College, Joplin, Missouri. The author was given permission to ask students in various classes to participate in the study. Selection was based on the author entering a class and choosing the first person seated in the first row to the author's right, then the second person in the second row, third person in the third row and so on until the last row. Then the procedure was repeated beginning with the first person in the first row to the author's left. This procedure was carried out until forty students were selected from various classes. All students reported to have had 20/20 vision or corrected to 20/20 vision. Sixteen students were randomly selected from subpopulations of the original forty students and these were the final participants in the study.

Apparatus

Five green, square, paperboard cards with the ⌊ figure drawn on them were used for the HVI (see Figure 1). The cards were numbered from one to five on the back. A table measuring 210 cm by 122 cm and 76 cm high, a chair, and a normally lighted classroom were used to test the students. A display stand was used for card presentation as well as being a

screen so that the students could not see what was going on behind the screen. The display stand was angled two degrees and had a small protrusion so that the cards could be placed on the stand and not fall off. Score sheets were used to record the students responses. Numbers from one to five were randomly drawn and recorded as the order of card presentation on the score sheets.

Design

The forty students were given the EPPS in three testing sessions covering a three day period. The mean of all aggression scale percentiles for the volunteers was computed and those persons scoring above the mean of 43 percentile were considered as the aggressive test group and those scoring below 43 percentile were considered as the less aggressive test group. This resulted in two subpopulations of level of aggression. The sample distribution scores were skewed slightly to the right which compares to the normative distribution of EPPS aggression scores. From the aggressive test group, eight students were randomly drawn using a blind drawing method and defined as the aggressive group. From the less aggressive test group, eight students were randomly drawn using the same drawing method and defined as the less aggressive group. These two groups of students were presented the HVI.

A systematic observation study using an independent variable classified in two ways and analysis of the means

using a t-test as suggested by McGuigan (1968) was used. The level of significance was established as a $p < .05$, assuming the null hypothesis that no difference exist between the two subpopulation samples.

Procedure

The aggressive group was tested on one day (within four days after taking the EPPS) and the less aggressive group was tested the following day. The students were taken one at a time into the test room and seated at the end of the table 150 cm from the display stand and read the following: This study involves your judgments as to which of two lines on a card is longer. There will be two lines on a card, one horizontal, the line drawn from left to right, and one vertical, the line drawn from top to bottom, which you must compare and make a judgment. You must make your judgment within ten seconds and answer either vertical longer or horizontal longer. These are your only answers. Remember, vertical is top to bottom and horizontal is left to right. Do you have any questions? If the student responded in the affirmative, the instructions were repeated. The cards were then presented one at a time in the randomly arranged order as indicated on the score sheet. After each card presentation the student was asked to close his eyes and wait until he was told to reopen them. Students judgments were recorded for six blocks of five cards each block. It was assumed that the students thought they were viewing thirty different cards. After the thirty

presentations were given, the student was excused and the next student was tested.

CHAPTER IV

RESULTS

The total number of wrong judgments were recorded as the students score. The data and a summary of the t-test for comparison of the group means is presented in the Appendix. A summary of all student's judgments by cards is presented in Table I. The null hypothesis was rejected, $t(14) = 2.97$, $p < .02$, because there was a significant difference between the group means. The aggressive persons did make more wrong judgments on the HVI than the less aggressive persons.

Due to the small number of subjects used in each group, the Mann-Whitney U test was applied to the data using the method suggested by Siegel (1956). This statistical application resulted in a $p < .02$, which supports the results of the t-test. A summary of this test is presented in the Appendix.

TABLE I

ALL STUDENTS JUDGMENTS ON CARDS

		CARD NUMBER				
Group	Judgment	1	2	3	4	5
Agg.	V > H	35	33	39	39	16
	V < H	13	15	9	9	32
Less Agg.	V > H	46	39	39	20	6
	V < H	2	9	9	28	42

On Cards 3, 4, and 5, 65% of the judgments by the aggressive group indicated a positive illusion, compared with 45% from the less aggressive group. For a negative illusion effect (horizontal judged longer than vertical, when vertical was longer than horizontal), 29% of the judgments of the aggressive group indicated a negative illusion as compared to 11% from the less aggressive group. Out of a total of 192 judgments (judgments on Card 3 were not counted) per group, 43% of the aggressive persons judgments were errors by definition as compared to 19% of the less aggressive persons judgments. The relationship of HVI errors in judgment to aggression level is shown in Figure 2.

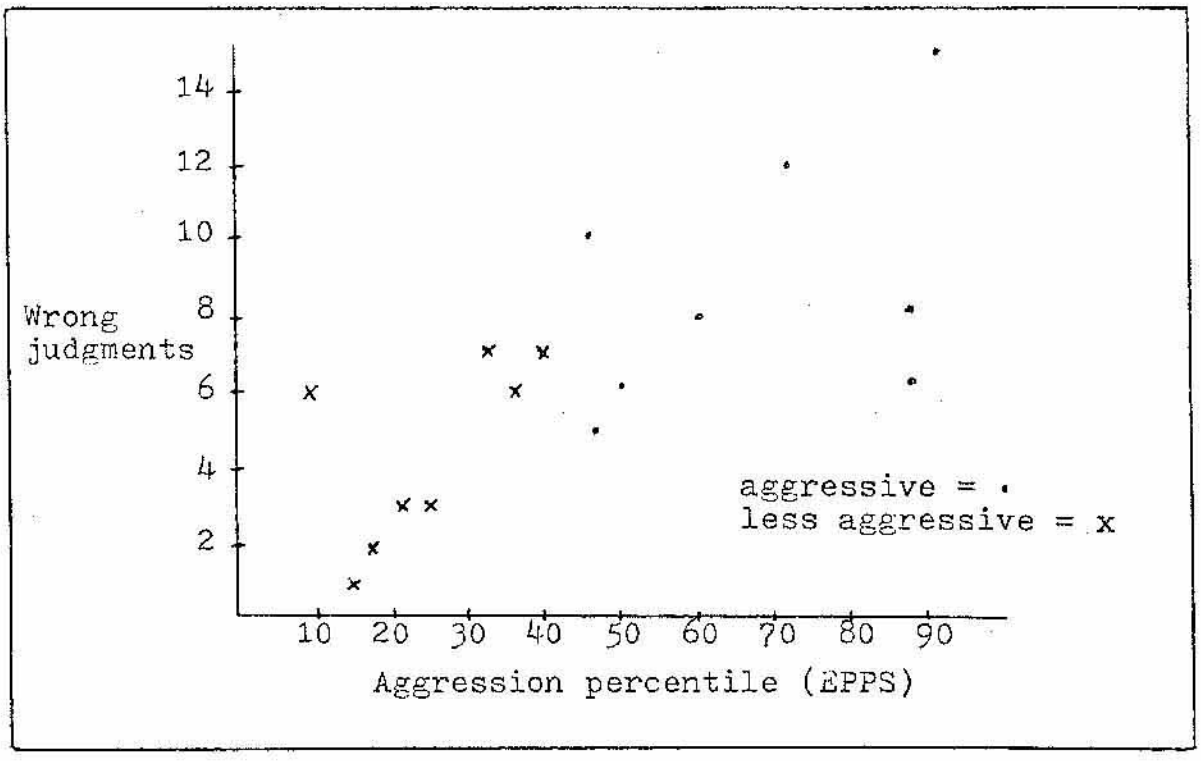


Figure 2. Students Wrong Judgments and Aggression Percentile

CHAPTER V

DISCUSSION

There is little question but the findings of this study confirms that perception of the HVI is influenced by level of aggression. However, the responses of the students were determined by something more than the level of aggression with which this study was concerned as indicated by the range of scores. Results of this study may offer an explanation of unexpected differences in perception of the illusion found in previous research.

Most often studies concerning perception of the HVI have been centered on the relationship that a certain response class is a function of a certain stimulus class, or $R = f(S)$. Obviously the visual system and its mechanisms must operate according to the laws that govern their activity. When the horizontal-vertical stimulus is perceived, it can be assumed that the visual laws have been in effect and that the response is dependent upon these laws. But if this were actually all that was involved in perception of the HVI, why do some persons differ in their responses? For example, if in a study a random population sample was chosen and if this sample was presented the same HVI stimulus, differences in responses may exist. These differences may not be significant. However, assuming $R = f(S)$, and assuming the visual laws were in effect, then how does one explain the differences? It could be that organismic variables were an influencing factor

in perception of the illusion and that these variables were not being accounted for. The present study gives evidence that organismic variables do influence perception of the HVI.

In a population sample there exist subpopulations. It has been shown by Dawson et al. (1973), Jones (1974), and Segall et al. (1963) that when subpopulations (cultural environments) were classified, significant differences in perception of the HVI existed. This suggests that R = f(O), i.e., a response class is a function of (class of) organismic variables. This relationship is a better type for studying the HVI. Since the stimulus (the horizontal-vertical lines) can be held constant and assuming the visual laws are operating, the response is now dependent upon the organism. In studies concerning the HVI, the relationship, R = f(S) has been examined thoroughly and yet no satisfactory explanation of the illusion has been advanced. Much information has been gained from this type of relationship, but this type leaves out the most important component in perception of the illusion and that component is the person.

In developing perceptual skills, an individual must learn by doing. Perhaps some people fail in perceptual efficiency because of a lack of habit-forming experiences, as suggested by Bean (1938). In personality development, certain needs may serve in a selective sensitizing manner which distorts stimuli, in an effort to fulfill the overall need mechanisms of the personality. Some people respond to stimuli in "characteristic" ways which one may use in evaluating and

classifying one's personality. In their personality development have these people learned to distort apperception to fit in with their need mechanisms? Kolb (1973) has stated "Perception and learning are necessary concomitants of the thinking process. Perception is not sensation; it implies the recognition of an object, an image, or a thought. Perceptions then often represent integrations of many sensations recorded in the brain as the central integrating organ" (p. 63). Many facets reveal the complexity and significance of perception in human personality. Some experimental conclusions point to the fact that the most accurate objective results may still not describe the true experience of the observer. Psychologists can not ignore this phenomenological aspect in behavioral research. In considering the influence of personality and motivation on the process of perception, researchers must assume a more global approach. In personality and perceptual studies, many factors have been discussed as isolated aspects, which could be merged to form a total, more meaningful and realistic explanation of behavior.

This study was concerned with the relationship $R = f(O)$ and results have shown that level of aggression was a significant factor in perception of the HVI. It may be shown in the future that other organismic variables have a greater or lesser influence on the perception of the HVI. Any adequate theory explaining the HVI must include organismic factors.

APPENDIX

Aggression scale statements on the Edwards Personal Preference Schedule (Edwards, 1959).

I like to attack points of view that are contrary to mine.

I feel like criticizing someone publicly if he deserves it.

I get so angry that I feel like throwing and breaking things.

I like to tell other people what I think of them.

I feel like making fun of people who do things that I regard as stupid.

I like to read newspaper accounts of murders and other forms of violence.

I feel like blaming others when things go wrong for me.

I feel like getting revenge when someone has insulted me.

I feel like telling other people off when I disagree with them.

Summary of t-test comparison of the group means.

Aggressive Group	Less Aggressive Group
15	7
12	7
10	6
8	6
8	3
6	3
6	2
5	1

$\Sigma X_1 = 70$ $\quad \Sigma X_2 = 35$

$\Sigma X_1^2 = 694$ $\quad \Sigma X_2^2 = 193$

$n_1 = 8$ $\quad n_2 = 8$

$\bar{X}_1 = 8.75$ $\quad \bar{X}_2 = 4.37$

$SS_1 = 81.5$ $\quad SS_2 = 39.87$

$$df = 16 - 2 = 14$$

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\left(\frac{SS_1 + SS_2}{(n_1 - 1)+(n_2 - 1)}\right)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

$$t = 2.97$$

$$t(14) = 2.97,\ p < .02.$$

Summary of Mann-Whitney U Test.

Aggressive Group	Less Aggressive Group
15	7
12	7
10	6
8	6
8	3
6	3
6	2
5	1

$n_1 = 8$ $\qquad$ $n_2 = 8$

$R_1 = 90$ $\qquad$ $R_2 = 46$

$$U = n_1 n_2 + \frac{n_1 (n_1 + 1)}{2} - R$$

$U = 10$ $\qquad$ $U = 54$

$U_s = 10$, $n_1 = 8$, $n_2 = 8$, $p < .02$.

$$z = \frac{U_s - \frac{n_1 n_2}{2}}{\sqrt{\left(\frac{n_1 n_2}{N(N-1)}\right)\left(\frac{N^3 - N}{12}\right) - \Sigma T}}$$

$z = 2.33$, $p < .019$.

REFERENCES

REFERENCES

Avery, G.C. Errors of standard in the horizontal-vertical illusion. Perception and Psychophysics, 1973, 8, 26-28.

Avery, G.C., & Day, R.H. Basis of the horizontal-vertical illusion. Journal of Experimental Psychology, 1969, 81, 376-380.

Avery, G.C., & Day, R.H. Relationship between the horizontal-vertical illusions for velocity and extent. Journal of Experimental Psychology, 1971, 89, 22-31.

Bean, C.H. The blind have "optical illusions". Journal of Experimental Psychology, 1938, 22, 283-289.

Becker, J.A. Division and orientation in the vertical-horizontal illusion. Perceptual and Motor Skills, 1972, 34, 899-902.

Begelman, D.A., & Steinfeld, G.J. An investigation of several parameters of the horizontal-vertical illusion. Perception and Psychophysics, 1967, 2, 539-543.

Begelman, D.A., & Steinfeld, G.J. Retinal vs phenomenal determinants of the horizontal-vertical illusion. Journal of General Psychology, 1971, 85, 77-85.

Bruner, J.S., & Goodman, C.C. Value and need as organizing factors in perception. Journal of Abnormal Social Psychology, 1947, 42, 33-44.

Bruner, J.S., & Postman, L. Symbolic value as an organizing factor in perception. Journal of Social Psychology, 1948, 27, 203-208.

Cohen, J. Sensation and perception. Eyewitness Series in Psychology (Series separate 4). Chicago: Rand McNally, 1969. (a)

Cohen, J. Personality assessment. Eyewitness Series in Psychology (Series separate 18). Chicago: Rand McNally, 1969. (b)

Cormack, E.O., & Cormack, R.H. Stimulus configurations and line orientation in the horizontal-vertical illusion. Perception and Psychophysics, 1974, 16, 708-212.

Day, R.H., & Avery, G.C. Absence of the horizontal-vertical illusion in haptic space. Journal of Experimental Psychology, 1970, 83, 172-173.

Dawson, J.L., Young, B.M., & Choi, P.P. Developmental influences on geometric illusion susceptibility among Hong Kong Chinese children. Journal of Cross-Cultural Psychology, 1973, 4, 49-74.

Deregowski, J.B. The horizontal-vertical illusion and the ecological hypothesis. International Journal of Psychology, 1967, 2, 269-273.

Doyle, M. Perceptual skill development — A possible resource for the intellectually handicapped. American Journal of Mental Deficiency, 1967, 71, 776-782.

Edwards, A.L. Edwards Personal Perference Schedule. New York: The Psychological Corporation, 1959.

Finger, F.W., & Spelt, D.K. The illustration of the horizontal-vertical illusion. Journal of Experimental Psychology, 1947, 37, 243-250.

Freeman, F.S. Theory and practice of psychological testing (3rd ed.). New York: Holt, Rinehart, & Winston, 1962.

Fry, C.L., & Craven, R.B. A developmental examination of visual and of active and passive tactual horizontal-vertical illusions. Journal of Genetic Psychology, 1972, 121, 127-132.

Gekoski, N. Psychological testing — Theory, interpretation and practices. Springfield, Ill.: Charles C. Thomas, 1964.

Graham, C.H. (Ed.). Vision and visual perception. New York: John Wiley & Son's, 1966.

Gregory, R.L., & Gombrich, E.H. (Eds.). Illusion in nature and art. New York: Charles Scribners Son's, 1973.

Harris, V.A., Hayes, W., & Gleason, J.M. The horizontal-vertical illusion: binocular and dichoptic investigations of bisection and verticality components. Vision Research, 1974, 14, 1323-1326.

Jones, P.A. Intra-cultural differences in susceptibility to geometrical illusions and in pictorial depth perception. Perceptual and Motor Skills, 1974, 38, 188-190.

Kaufman, L. Sight and mind. New York: Oxford University Press, 1974.

Kaufmann, H. Aggression and altruism. New York: Holt, Rinehart, & Winston, 1970.

Kolb, L.C. Modern clinical psychiatry (8th ed.). Philadelphia: W.B. Saunders, 1973.

Kunnapas, T.M. An analysis of the "vertical-horizontal illusion". Journal of Experimental Psychology, 1955, 49, 134-140.(a)

Kunnapas, T.M. Influence of frame size on apparent length of a line. Journal of Experimental Psychology, 1955, 50, 168-170.(b)

Kunnapas, T.M. The vertical-horizontal illusion and the visual field. Journal of Experimental Psychology, 1957, 53, 405-407.

Landauer, A.A., Rhine, C.A., & Rumiz, L. Overestimation of vertical movement. Psychonomic Science, 1968, 10, 59-60.

Leibowitz, H.W. Visual perception. New York: MacMillan, 1965.

MacLeod, R.B., & Pick, H.C. (Eds.). Perception: Essays in honor of James J. Gibson. New York: Cornell University Press, 1974.

McGuigan, F.J. Experimental psychology (2nd ed.). New Jersey: Prentice - Hall, 1968.

Murray, H.A., & et al.. Explorations in personality. New York: Oxford University Press, 1938.

Over, R. Explanations of geometrical illusions. Psychological Bulletin, 1968, 70, 545-562.

Pearce, D., & Matin, L. Variation of the magnitude of the horizontal-vertical illusion with retinal eccentricity. Perception and Psychophysics, 1969, 6, 241-243.

Postman, L., Bruner, J., & McGinnies, E. Personal values as selective factors in perception. Journal of Abnormal and Social Psychology, 1947, 42, 142-154.

Schiffman, H.R., & Thompson, J.G. The role of eye movements in the perception of the horizontal-vertical illusion. Perception, 1974, 3, 49-52.

Schiffman, H.R., & Thompson, J.G. The role of figure orientation and apparent depth in the perception of the horizontal-vertical illusion. Perception, 1975, 4, 79-83.

Schiller, P., & Wiener, M. Binocular and stereoscopic viewing of geometric illusions. Perceptual and Motor Skills, 1962, 15, 739-747.

Segall, M.H., Campbell, D.T., & Herskovits, D.T. Cultural differences in the perception of geometric illusions. Science, 1963, 139, 769-771.

Siegel, S. Nonparametric statistics for the behavioral sciences. New York: McGraw - Hill, 1956.

Tedford, W.H., & Tudor, L.L. Tactual and visual illusions in the T-shaped figure. Journal of Experimental Psychology, 1969, 81, 199-201.

Teghtsoonian, M. Apparent length as a function of tilt does not depend on orientation of the standard. Journal of Experimental Psychology, 1972, 94, 191-197.

Thompson, J.G., & Schiffman, H.R. The influence of figure size and orientation on the magnitude of the horizontal-vertical illusion. Acta Psychologica, 1974, 38, 413-420.

Thurstone, L.L. A factorial study of perception. Chicago: University of Chicago Press, 1944.

Underwood, B.J. Experimental psychology (2nd ed.). New York: Appleton-Century-Crofts, 1966.

Vernon, M.D. (Ed.). Experiments in visual perception. Baltimore: Penguin Books, 1966.

Warren, R.M., & Warren, R.P. Helmholtz on perception: Its physiology and development. New York: John Wiley & Son's, 1968.

Wober, M. Horizons, horizontals, and illusions about the vertical. Perceptual and Motor Skills, 1972, 34, 960.

Wong, T.S. A further examination of the developmental trend of the tactile horizontal-vertical illusion. Journal of Genetic Psychology, 1975, 127, 149-150.