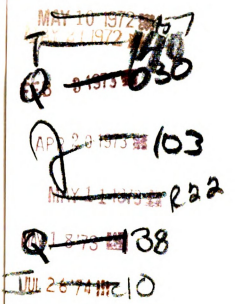
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ABSTRACT

THE RELATIONSHIP OF VISUAL PERCEPTUAL CAPABILITIES AS MEASURED BY THE PERCEPTION OF TRAFFIC HAZARDS TEST AND BEHAVIORAL CATEGORIES AS MEASURED BY THE MANN INVENTORY

By

William Laurance Quane

Recent studies have indicated that two factors were extremely important in motor vehicle driving. These factors were visual perception and personal and social adjustment.

The primary purpose of this investigation was to determine the relationship between visual perceptual capabilities and behavioral categories. An attempt was made to determine if individuals classified into distinct behavioral categories using the Mann Inventory would respond differently to the items in the Perception of Traffic Hazards Test.

A secondary purpose of this investigation was to determine whether there was a significant relationship between the two test instruments.

The public high schools of Lansing and East Lansing, Michigan, were selected for this investigation on the basis of:

1. Large student bodies representing a broad cross-section of the population;
2. The availability of cooperative and qualified professional driver education teachers in each of the driver education programs.

The students in the sample population completed both test instruments during the first five weeks of the fall semester of 1969. The days selected for the administration of the test instruments were selected so as to preclude the effects of the visual training which was to be received in driver education classes.

The hypotheses were tested using a one-way analysis of variance, a t-test for significance and a product-moment correlation.

Statistical analysis of the data revealed:

1. No significant differences existed between individuals in the six behavioral categories with regard to visual perceptual capabilities. The findings showed no significant differences existed when the total positive or total negative components of the visual perception score or the total adjusted scores were analyzed. The selected level of significance was .05.
2. No significant differences in visual perceptual capabilities existed between individuals with regard to overall adjustment. The findings

demonstrated no significant difference existed between individuals characterized as reasonably well-adjusted and those individuals characterized by problems in adjustment. A significance level of .05 was required.

3. The correlation between the test instruments was very low. The correlation coefficient between the total adjusted visual perception score and the adjustment scale score was -0.01.
4. There were no significant differences on the variables measured on the basis of sex. Analysis of both males and females were very similar at non-significant levels.

THE RELATIONSHIP OF VISUAL PERCEPTUAL CAPABILITIES AS MEASURED BY THE PERCEPTION OF TRAFFIC HAZARDS TEST AND BEHAVIORAL CATEGORIES AS MEASURED BY THE MANN INVENTORY

By

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TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

THE PROBLEM

The toll of deaths due to motor vehicle collisions has increased by alarming numbers yearly. The number of fatalities and injuries resulting from these collisions has risen dramatically since the early 1950's. This large upswing has been apparent in the number of deaths reported to the National Center for Health Statistics: 1950, 34,763 died on our highways; 1956, 39,628 died; 1965, 49,163 lives lost; and in 1968, 55,200 people lost their lives as a result of collisions on our highways. Besides this tragic loss of life, it has been estimated that over two million individuals received disabling injuries in 1968. The estimate of financial losses due to the 14,600,000 collisions occurring in 1968 was a staggering $11,300,000,000.[1]

In spite of many varied and extensive improvements in highway engineering, traffic enforcement and traffic and driver education, the forecast for the future is not encouraging, and it is predicted that an increase in the number of deaths will occur each year.

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[1] Accident Facts, 1969 edition, National Safety Council, pp. 40,59.

> Stated otherwise, the problem is worsening more rapidly than the capability of counter-measures thus far implemented to deal with it. If unchecked, motor vehicle crashes will produce at least a quarter of a million fatalities on our highways in the next four years, reaching an aggregate total in 1972 of 2 million deaths since 1900.[2]

The bulk of the death producing collisions were caused by a combination of human errors, some of which could be eliminated thus tending to mitigate the problems. A few improper driving habits "are often advanced as the causes or factors that were present relating to collisions."[3] These inappropriate driving procedures: speed too fast for conditions, failure to yield the right of way, drove left of center, improper overtaking, made improper turn, followed too closely, and other improper driving, were probably only symptomatic of the true causes of accidents.

Recently, research on the total task which the safe driver must perform has revealed that visual perception is a key factor in automobile driving. Quensel pointed out that not only does the driver need good visual equipment, i.e. visual acuity, field of vision, low illumination vision, etc., but he must know how to use it efficiently if collisions are to be avoided. An index of the driver's

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[2]U.S. Department of Transportation, "Second Annual Report to the Congress on the Administration of the Highway Safety Act of 1966." Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., p. 3.

[3]National Safety Council, op. cit., p. 48.

effectiveness in the ability to use his visual capabilities is seen in the timing of routine actions, such as those found in improper driving habits.[4]

In research dealing with human performance, Briggs commented on man's limitations as a detector of traffic cues:

> The problem comes when the amount of available information exceeds the ability of the driver to notice it, analyze it, make a valid decision, and perform the necessary physical maneuver to effectively carry out the decision. Since a person can only make effective use of a limited amount of information at one time, one priority area for improvement is in the way information is presented to the driver.[5]

One method of accomplishing the improvement necessitated by a driver's inability to detect traffic clues efficiently is traffic simulation. Simulation has been used extensively for aviation purposes and most recently and dramatically in space exploration. In these fields, simulation has been found to be most beneficial from a financial as well as from a training results viewpoint. In driving simulation, similar results have been obtained when proper methods and techniques are employed. Learners were taught to perceive key events in the traffic scenes which were presented on 16mm programmed instructional films. This learning to

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[4]W. Quensel, "The Role of Visual Perception in Driving," Illinois High School and College Driver Education Association Quarterly Journal, II, 1 (January, 1968) p. 7.

[5]G. Briggs, "The Driver in Danger." Analogy (Spring, 1968), pp. 16-17.

perceive key events in traffic scenes was one of the most important aspects of simulation training. When learners had a visually-oriented frame of reference, instead of feeling that simulation instruction was "just like driving," meaningful learning was transferred to behind the wheel instruction. Life-like driving sequences allowed the hazards to be seen and responded to in a non-threatening, risk-free situation which facilitated initial learning.

The concept of driving simulation has been gathering much support in recent years. In fact, many colleges and universities across the country have courses specifically designed to teach their students the theories and proper instructional techniques of using driving simulators.[6] These students, after completing their training, may be employed as teachers in the rising number of schools and school districts which use driving simulators. As of November of 1968, there were at least 238 separate simulator installations throughout the nation.[7]

Many research studies have been conducted investigating different aspects of driving simulation. Studies in Los

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[6]R. Semonisck, "Driver and Safety Education Courses--A Survey of Colleges and Universities," Safety, V, 2 (March-April, 1969) pp. 26-37.

[7]Allstate Good Driver Trainer or Aetna Drivotrainer; Allstate Insurance Company Driver Education Section, "Installations of Link Driving Simulators Utilizing the Allstate Good Driver Trainer Program." A Summary presented to the 1969 Allstate Advisory Board, Northbrook, Illinois, March, 1969.

Angeles; Iowa; Springfield, Pennsylvania; and Washington, D.C.,[8] have shown that driving simulation programs can indeed replace some of the in-car, behind-the-wheel training needed by beginning drivers.

More recently, investigations at Illinois State University have reported that simulation training makes drivers significantly more perceptive of traffic hazards.[9] Simulation programs have also been suggested as one means of improving driver education on a state-wide basis.[10]

A driver's personality and observed behavior have been found to be of very significant importance to driving performances. Pelz reported that drivers between the ages of sixteen and twenty-six are in a decade of turmoil. During this ten-year period, teens strive for adult status, but society refuses to grant the privilege, thus leading to emotional unrest and aggressive anti-social impulses.

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[8] J. Fox, Driver Education and Driving Simulators, National Commission on Safety Education, Washington, D.C., pp. 36-57.

[9] K. McPherson, "Perception of Traffic Hazards: A Comparative Study." Unpublished Master's Thesis, Illinois State University, 1966; E. Dorner, "The Effect of Active Versus Passive Traffic Simulation Instruction on Visual Perception." Illinois High School and College Driver Education Association Quarterly Journal, II, 4 (October, 1968) pp. 4-10; A. Robinson, "The Influence of Programmed Instructional Films on Perception of Traffic Hazards" (unpublished Master's thesis, Illinois State University, 1968)

[10] R. Nolan and R. Gustafson, How To Improve Driver Education In Michigan. Highway Traffic Safety Center, Michigan State University, December, 1966, pp. 81-83.

Also, he noted several psychological inventories have been developed which have been used for predicting safe drivers.[11]

Kenel found that individuals who would have poor driving records could be identified on the basis of their observed behavior and/or a personality inventory.[12] These findings correlate with the widely accepted "you drive as you live" theory expounded by many well known exponents.[13]

Judson Branch chairman and chief executive office of Allstate Insurance Companies has commented succinctly concerning behavioral research and traffic safety:

> Results are what we all seek. Results are demanded of us because of the real crisis we are facing in the 100 plus lives lost every day, and the 10,000 plus injuries every day. To the extent that a dollar sign can replace human misery, all of this adds up to an unbelievable $900 million a month in economic loss--and each year it increases. To reverse this tide would indeed be an accomplishment.
>
> I am confident that driver behavior research can help to do this . . .[14]

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[11] D. Pelz, "Driver Motivation and Attitudes." Driver Behavior-Cause and Effect, Insurance Information Institute, Washington, D.C., pp. 101-122.

[12] F. Kenel, "The Effectiveness of the Mann Inventory in Classifying Young Drivers Into Behavioral Categories and its Relationship to Subsequent Driver Performances" (unpublished Doctoral dissertation, Michigan State University, 1967).

[13] A. Ribicoff, "You Drive As You Live," Analogy (Winter, 1966-67), pp. 16-18.

[14] J. Branch, Keynote Address at the Second Annual Automobile Insurance Industry Traffic Safety Research Symposium, Quoted in Driver Behavior-Cause and Effect, Northbrook, Illinois, 1968.

As possible explanations of the reasons people become involved in traffic collisions, visual perception and personality characteristics seem to provide promising avenues for investigation. Each of these factors are important in the study of reducing the number of deaths on our highways, and the relationship between them may be of utmost importance.

Statement of The Problem

The primary purpose of this study was to investigate the relationship between the traffic related visual perceptual capabilities of individuals in six different behavioral categories using the Perception of Traffic Hazards Test and the Mann Inventory.

A secondary purpose of this investigation was to determine the relationship between the Perception of Traffic Hazards Test and the Mann Inventory.

Basic Assumptions

The investigation of this problem was based on the following assumptions:

An understanding of behavior in the driving of a motor vehicle is necessary to identify the underlying causes of traffic collisions.

Visual perceptual capabilities as related to traffic can be measured effectively using static 35mm slides presented in the Perception of Traffic Hazards Test.

The Mann Inventory can be used to place individuals into distinct, behavioral categories.

The Hypotheses

The hypotheses to be tested in this study were:

$H_0$1: There are significant differences in the visual perceptual capabilities as measured by the Perception of Traffic Hazards Test of individuals in the six behavioral categories as measured by the Mann Inventory.

$H_0$2: There is a significant positive difference in visual perceptual capabilities as measured by the Perception of Traffic Hazards Test of individuals in categories one, two and three as compared with individuals in categories four, five and six as measured by the Mann Inventory.

$H_0$3: There is a significant relationship between the total numerical score attained by an individual on the Perception of Traffic Hazards Test and their score on the adjustment scale of the Mann Inventory.

Definition of Terms

Mann Inventory

A personality inventory consisting of sixty-three items which attempts to measure an individual's feelings toward himself, others, and established social conventions

(hereafter, it may be referred to as the "Inventory"). Responses to the items in the "Inventory" are expressed by checking one of five responses--always, usually, sometimes, rarely or never.

Perception

The process by which an individual maintains contact with his environment. For the purposes of this study, this process is considered to be both physical and mental.

Perception of Traffic Hazards Test

A series of fifteen 35mm slides depicting hazardous traffic situations within various driving environments projected on a screen for five seconds each. A pre-recorded presentation provides two to five choices of possible hazards existing within each scene. Immediately after a test slide is removed from the screen, each subject is asked to place an "X" on a multiple choice answer sheet if the hazard was present.

Since various hazards in different driving environments present differing degrees of hazard to a driver, the identified hazards are assigned values of from +1 to +3, totaling to a possible raw score value of +72 points. Included among the possible choices are certain false checks (pseudo-hazards) which were assigned negative values of -2 and -3, totaling to a possible raw score

value of -41. The arithmetic total of the positive and negative raw score values is designated as the subject's total adjusted score or visual perceptual capability for this study. (Hereafter this test may be referred to as the "Perception Test" or PTHT.)

Visual Perception

The process of perception using the visual sense modality. For the purposes of this study, visual perception will be considered to be recognition or discriminatory responses made by the individual when exposed to a visual stimulus. The portion of perception which deals with interpretation of stimuli will not be considered.

Organization of the Study

The general plan of this study is to present in Chapter II the review of literature of two areas: the role of visual perception in driving and the relationship of personality and personal or social adjustment to driving performance. Chapter III contains a description of the test instruments used, an account of the methods used in collecting, organizing and tabulating the data and the statistical techniques applied in analyzing them. The results of the analyses appear in Chapter IV and the summary, conclusions and recommendations for further study are presented in Chapter V.

CHAPTER II

REVIEW OF LITERATURE OF THE RELATIONSHIP OF PERSONALITY AND SOCIAL ADJUSTMENT AND VISUAL PERCEPTION TO ACCIDENT INVOLVEMENT

Perhaps the most significant contribution of the accident-proneness concept has been to lead investigators to find alternative explanations to the differing rates of mishap involvement among people. Since the idea of accident proneness was introduced as a scientific concept in the 1920's, it has fostered many ardent disciples as well as those who have tried to disprove it.

One of the most convincing studies attempting to establish a basis for the accident proneness concept was undertaken by Greenwood and Woods.[15] Using frequency distributions of accidents among munition factory workers, the investigators attempted to demonstrate that distributions of accidents did not approximate the normal curve (chance) nor that of a biased distribution, i.e. individuals in the population having experienced one accident would be

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[15]M. Greenwood and H. Woods, "The Incidence of Industrial Accidents with Special Reference to Multiple Accidents," as reprinted in Accident Research Methods and Approaches, Haddon, pp. 389-397. Medical Research Committee, Industrial Fatigue Research Board, Report No. 4, 1919.

more likely (biased) to have another. Their results indicated that different individuals were "susceptible" to accidents in varying degrees; and therefore, in order to eliminate a large number of the accidents, the remedial action that was needed was the removal of the "susceptible" workers.

Farmer and Chambers,[16] using the accident involvement of London omnibus drivers, concluded that the accident proneness of some drivers contributed to the causation of the accidents in which these drivers were involved. They also concluded, that this phenomonon of accident proneness was present regardless of the type of accident or the conditions under which it took place.

Thus the general public has viewed the accident proneness concept to this day. However abused this concept is, no one has yet obtained evidence to disprove the theory entirely.[17] Instead, many researchers have looked to the behavioral sciences to seek answers to the question of accidents. The areas of the psychological and social adjustment of individuals seem to present very promising explanations to questions posed concerning the factors involved in the causes of accidents.

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[16]E. Farmer and E. Chambers, "A Study of Accident Proneness Among Motor Drivers," as reprinted by Haddon in Accident Research Methods and Approaches, pp. 410-417. Medical Research Council, Industrial Research Board (Great Britian), Report No. 84, 1939.

[17]G. Miller, "Accident Repeaters May Not Be Accident Prone," National Safety News, LXVII (March 1963), p. 6.

Adler[18] compared groups of workers with varying numbers of repeated accidents and found that basically five types emerged from the analysis. These groups were identified by:

1. a definitely bitter and revengeful attitude toward a parent or educator, often concerning his being forced to take a particular job,
2. a strong feeling that being lucky or unlucky was involved in accidents,
3. a wish to be nursed or cared for,
4. extreme ambition,
5. a constant fear of becoming involved in accidents[19]

A classic study performed to investigate the psychological and social backgrounds of drivers who were involved in a disproportionately high number of accidents was done by Tillman and Hobbs.[20] For a period of three months, forty taxi-cab drivers were interviewed to obtain personal history information while they performed their job. The information obtained in the personal history included the parental background, childhood and adolescent

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[18]A. Adler, "The Psychology of Repeated Accidents in Industry," American Journal of Psychiatry, 98 (1941), pp. 99-102.

[19]Ibid.

[20]W. Tillman and G. Hobbs, "The Accident Prone Automobile Driver." A Study of Psychiatric and Social Backgrounds, The American Journal of Psychiatry, CVI, 5 (1949), pp. 321-331.

history, and subsequent adult adjustment. After this information was individually secured, the drivers were called into group discussions with each other to observe their individual adjustment to and standing within the groups. As additional sources of information, the police, juvenile authorities and social agencies were contacted.

The high accident group and the low accident group were compared with regard to several personality characteristics. Although the groups were small (twenty drivers in each), the results of the comparisons were highly significant. The high accident group was characterized by aggressiveness and the inability to tolerate authority, whether in the home or in the community. These characteristics appeared to be developed throughout childhood and continued through life often displayed as fits of temper. On the other hand, the low accident group appeared to be stable and well-adjusted individuals with well-integrated childhood experiences.

The characteristics which best described the high accident group were as follows:

1. Poor home life with a high rate of parental divorce accompanied by one or both parents being excessively strict. The father was often a poor provider, with a record of heavy drinking.

2. Inadequate childhood adjustment characterized by a history of instability of an aggressive nature, such as temper tantrums, fighting frequently, bully characteristics, leaders of gangs and frequent appearences in Juvenile Court. However, an almost equal number (nine) had a history described as regressive in nature with characteristics on the opposite extreme of the continuum.
3. Deficient social adjustment displayed as poor school attendance records, short-time employment, many acquaintances but few friends, shallow emotional attachments, impulsiveness, and a lack of interest in hobbies.
4. Immature behavior patterns displayed by using foul language, constantly seeking to be the center of attention when in a group, lack of concern over problems, and eccentric dress.[21]

In an attempt to apply the findings to the general driving public, since a sample of taxi drivers was not typical, a group of ninety-six drivers who had been involved in four or more collisions was selected for study as a more representative accident-repeater group. A comparable control group of one hundred accident-free motorists was also selected. The names included in both groups were

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[21] Ibid., pp. 324, 326.

submitted to the Juvenile Court, the Adult Court of records other than automobile accidents, three social service agencies, the public health agencies, venereal disease clinics and the local credit bureau to ascertain if these individuals were known to these agencies. In reply, it was found that sixty-six per cent of the high-accident group was known to one or more of the agencies while only nine per cent of the low-accident group were known to any of the agencies. In addition, no one in the low-accident group was known to more than one of the agencies.

A breakdown of the involvement of the high-accident group was enlightening. Two of the individuals were known to all of the sources, while three were known to four of the sources, nine to three of the sources, sixteen to two sources, and thirty-two to at least one source. The credit bureau had contacted more than one-third of the high-accident group (34.3%) as had the Adult Court for charges other than traffic (34.3%). The social service agencies had contact with 17.7% of the group, while the Juvenile Court had contact with 16.6%, and the venereal disease clinics knew 14.4% of the high-accident group.

On the other hand, the low-accident group was almost unknown to the referral agencies. The credit bureau had contact with six of the individuals; the social service agencies, the Juvenile Court and the Adult Court each had contact with one of the individuals in the low-accident

group. Thus, it was readily apparent that social maladjustment of various types was much more frequent among the high-accident group than among those individuals in the low-accident group.[22]

Rainey[23] and Conger[24] studied a series of small groups of highly selected accident-repeater and accident-free airmen. Using statistical analyses of the various scales and measures employed, no significant differences were found between the groups involving physiological reactions to stress or psychomotor functions, such as simple and complex reaction times, coordination and discrimination. However, on the Allport, Vernon and Lindzey Study of Values, the high-accident group did show an overemphasis on self-determination and self-sufficiency which could have reflected a rejection of conformity standards and conventional modes of behavior. Also the results showed a tendency for the accident-repeaters to respond to events or other persons in a highly emotional manner. Conversely, the accident-free group showed a tendency towards behavior which conformed

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[22] Ibid., pp. 327-330.

[23] R. Rainey, et al., "An Investigation of the Role of Psychological Factors in Motor Vehicle Accidents," Bulletin 212, Highway Research Bulletin, 1959.

[24] J. Conger, et al., "Psychological and Psychophysiological Factors in Motor Vehicle Accidents," The Journal of American Medical Association, 169 (April 1959), pp. 1581-1587; J. Conger, "Personal and Interpersonal Factors in Motor Vehicle Accidents," American Journal of Psychiatry, 113 (1957), pp. 1069-1075.

to societal customs and which demonstrated their ability to resolve conflicts within conventional standards and practices. Turrell reported similar findings using the Allport, Vernon and Lindzey Study of Values.[25]

Heath[26] found that a well adjusted group of drivers had a better overall driving record than poorly adjusted drivers. Also, a high-exposure group was more vigorous, more impulsive, more sociable, and less reflective than a group of accident-repeaters; but the high-exposure group had a better accident experience record than the accident-repeaters even though their exposure was greater.

Rommel[27] undertook a study to isolate personality characteristics and attitudes which might serve to distinguish youths who were accident-repeaters from those who were accident-free. The accident repeaters possessed certain attitudes or a combination of attitudes which were considered to be conducive to unsafe driving behavior. These attitudes which were derived from the Driver Attitude Inventory developed by Schuster and Guilford were as follows:

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[25]E. Turrell, "Emotions: Personality's Multiple Facets," Traffic Safety (December 1957), pp. 22-23, 53-54.

[26]E. Heath, "The relationship Between Driving Records, Selected Personality Characteristics and Biographical Data on Traffic Offenders and Non Offenders." Unpublished doctoral dissertation, New York University (1957) as printed in Highway Research Board, Bulletin 212, 1959, pp. 16-20.

[27]R. Rommel, "Personality Characteristics and Attitudes of Youthful Accident-Repeating Drivers," Traffic Safety Research Review, III, 1 (March 1959), pp. 13-14.

1. An attitude toward driving as a form of activity which relieves psychic tension.
2. An attitude toward driving as a form of behavior by which youthfulness may be compensated and the role of an adult may be assumed.
3. An attitude toward driving as a form of behavior in which a considerable amount of confidence in one's ability may be manifested.
4. An attitude toward driving which does not take into account speed as an element of danger or if considered dangerous, an attitude manifesting desire for danger.
5. An attitude toward driving which places greater emphasis on the power which a vehicle possesses than on either its style or utility.[28]

Also the accident-repeater group tended to indicate their disregard for social mores, which could be interpreted as an open defiance for authority, as well as a tendency toward excessive activity and enthusiasm.

The primary purpose of a study by Goldstein and Mosel[29] was to determine the factors underlying drivers' attitudes. A factor analysis identified five factors:

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[28] Ibid., p. 14.

[29] L. Goldstein and J. Mosel, "A Factor Study of Driver's Attutudes, with Further Study of Driver Aggression," Bulletin 172, Highway Research Board, 1958.

(a) attitude toward competitive speed, (b) attitude toward other users of the roadway, (c) attitude toward cops, (d) attitude toward the vehicle, and (e) a general attitude of care or concern for safety. Of these factors one, two, and three were substantially correlated. Factor four was almost orthoganal to the others, while factor five was highly correlated with the first three factors.

Several studies dealing with the prediction of future driving performance based their actions on personal and psychological data. Schuster[30] reported that attitude scales could be used to predict follow-up accidents and moving violations significantly. Also when attitude scales were combined with the previous driver record of moving violations and accidents an even better prediction could be made. Levonian[31] indicated that negligent operators could be identified at a statistically significant level on the basis of four variables: driving exposure, age, sex, and marital status. Kenel[32] found that the categorization of youthful drivers by personality types was highly correlated with subsequent driving behavior.

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[30]D. Schuster, "Prediction of Follow-Up Driving Accidents and Violations," Traffic Safety Research Review, XII, 2 (March, 1968), pp. 17-21.

[31]E. Levonian, "Prediction of Accidents and Convictions," Traffic Safety Research Review, XI, 3 (September, 1967) pp. 75-79.

[32]Kenel, op. cit., pp. 49-51.

Haner[33] reported on an insurance company's underwriting program based on their use. The prediction devices were a personal history form and a psychological inventory. He found that the inventory discriminated among those tested on the variable of the number of collisions involving primary negligence. Also the relationship between the risk group of the insured and the seriousness of injury in collisions when the insured was primarily at fault was found to be significant. An adequate prediction could be made using only the personal history form, but the best predictions were made when both the devices were used.

Extensive investigation of driving records by Crancer, Quiring and McMurray[34] has revealed several facts in the personal and social adjustment of drivers. It was found that:

1. Persons with a poor credit rating had more accidents and violations than the general driving population. Poor credit rating drivers also received a high proportion of negligent driving citations.

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[33]C. Haner, "Use of Psychological Inventory in Writing Insurance For Youthful Male Drivers," Traffic Safety Research Review, VII, 1 (March, 1963), pp. 5-9; C. Haner, "Use of Personal Data In Underwriting Setting," Traffic Safety Research Review, VII, 3 (September, 1963). pp.

[34]A. Crancer, D. Quiring, and L. McMurray, Report Nos. 010, 011, 012, 013, 014, 015, 016. Driver Research Project, Department of Motor Vehicles, State of Washington, June-August, 1968.

2. Individuals who were classified as psychoneurotic or who had personality disorders had a statistically higher accident and violation rate than comparable groups.
3. The accident rate of persons subsequently hospitalized for suicide gestures was 81% higher than the general driving population while the violation rate was 146% higher. This group had a significantly larger proportion of involvements for serious violations: drunken driving, reckless driving, hit and run, driving while license was suspended, and negligent driving. The proportion of bodily injury accidents was also higher.
4. During the six months prior to and immediately following the filing of a divorce petition, individuals had a disproportionately high record of accidents and violations, especially during the high-accident first three months after the filing.
5. Diabetics under treatment displayed a driving problem with a higher accident and violation rate than expected.
6. Persons arrested for illegal drug use had driving records which had a large proportion of violations for reckless, hit and run, and negligent driving as did those drivers who

were hospitalized as chronic alcoholics. Also the alcoholics were involved in a larger proportion of bodily injury accidents than the general driving population.

A very interesting and extensive ten year study was undertaken in Johannesburg, South Africa, by Shaw[35] to determine if bus drivers could be screened effectively to lower accident losses to a minimum. Two projective tests--the Thematic Apperception Test (TAT) and a variation, the Social Relations Test (SRT)--were administered to prospective drivers for the Public Utility Transportation Corporation (PUTCO). The results indicated a very strong relationship between the driving records and the responses to the two projective devices. In addition, the relationship between the total personality pattern and driving behavior and history was demonstrated.

Shaw was able to establish a general description of accident risks on which potential accident liability could be seen. A partial listing of this broad outline follows:

THE POTENTIALLY BAD ACCIDENT RISK

The badly integrated or maladjusted person.
The person with a distorted apperception of life and a distorted sense of values.

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[35]L. Shaw and H. Sichel, "The Reduction of Accidents in a Transport Company by the Determination of the Accident Liability of Individual Drivers," Traffic Safety Research Review, V, 4 (December, 1961), pp. 2-12; L. Shaw, "The Practical Use of Projective Personality Tests as Accident Predictors," Traffic Safety Research Review, IX, 2 (June, 1965), pp. 34-72.

The person who is emotionally unstable and extremistic.
The person who lacks controls, and particularly the person who exhibits uncontrolled aggression.
The highly ambitious and competitive person.
The over-confident, self-assertive person.
The person who harbors grudges, grievances and resentments.
The intolerant and impatient person.
The person with a marked antagonism to, and resistance against authority.
The inadequate person with a driving need to prove himself.
The helpless and inadequate person who is constantly in need of guidance and support.
The person who is very lacking in personal insight and an appreciation of his own limitations.
The person who exhibits the personality characteristics commonly associated with immaturity, such as: foolhardy impetuosity, irresponsibility, exhibitionism, inability to appreciate the consequences of his actions, hypersensitivity, easily aroused emotionalism, unrealistic goals and a general lack of self-discipline, personal insight, worldly wisdom and common sense.

THE POTENTIALLY POOR ACCIDENT RISK

The person who displays little energy, stamina or interest.
The person who exhibits the personality faults of the bad accident risk, but in a less pronounced manner.
Also included in this group is the person whose faults or weaknesses are such that they could possibly improve in time, but the learning process is likely to be so expensive that he is really a poor risk--especially as a professional driver.

THE POTENTIALLY BORDERLINE ACCIDENT RISK

(Prediction of liability is difficult because certain important elements in the personality structure could improve or deteriorate depending on the stresses encountered in the future.)
The weak person who could be easily influenced.
The person who is nervous and lacking in self-confidence.

The person who has unresolved conflicts, but who gives evidence of a constructive, but as yet unsuccessful, effort to make adequate adjustments to these conflicts.
The person with a not-too-pronounced anxiety neurosis (this may make him ultracautious at the moment but he must be regarded as a doubtful risk, as he may deteriorate.)

THE POTENTIALLY FAIR ACCIDENT RISK

The person whose intentions are good, even if his capabilities are not always commensurate with his intentions.
The person who has certain weaknesses or unresolved conflicts which, although they will not unduly upset the balance of his personality, will nevertheless always impose a certain strain on him and slightly impair his efficiency.
The highly intelligent person with a tendency to abstract thought, aesthetic interests and mental preoccupation.
Also included in this group is the person whose faults and weaknesses are such that they will probably improve in time but who at the moment cannot rise above them and who is currently therefore only a fair risk.

THE POTENTIALLY GOOD ACCIDENT RISK

The balanced and mature and well-controlled person with a healthy and realistic outlook, satisfactory interpersonal relations, a kindly and tolerant attitude to others, a well developed social and civic conscience and an ingrained sense of responsibility.
The person who, as yet, cannot be said to be quite mature but whose motivations are sound and who demonstrates an ability to learn quickly by experience and profit by his mistakes. (This sort of person will undoubtedly have a learning period before his record stabilizes itself at a good level.)
The contented person who is in no way outstanding but who is friendly, cheerful, adaptable and accepting--.
The rather withdrawn introvert--provided that he is not too maladjusted.

> The person who has his weaknesses and limitations but is realistically aware of them and who is careful and cautious and moderates his behavior according to his limitations.[36]

Shaw stressed, however, that this outline was not a concise formula for determining accident risks but that the total personality pattern was the important concern, especially the balance and integration of that pattern. Even if an individual appeared balanced, but in reality there was a pronounced imbalance of any kind, the prognosis for accident liability was poor.

Forbes[37] recognized that the study of psychological factors was an extremely important part of reducing the accident problem but he also stated:

> . . . it is necessary to recognize that psychological factors are usually critical in accident causation as one part of a combination of environmental and highway factors which may suddenly increase the difficulty of the task for the driver. Important as psychological factors are, we cannot look at them as the one cause for an accident.[38]

Another factor which has been advanced as one of the multiple causes implied by Forbes was faulty visual perception. Brody stated:

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[36] Ibid., pp. 64-65.

[37] T. Forbes, "Human Factors in Highway Safety," Traffic Safety Research Review, IV, 1 (March, 1960), pp. 8-11.

[38] T. Forbes, "Psychological Factors in Traffic Accidents on Freeways," Traffic Safety Research Review, II, 4 (December, 1958), pp. 24-26.

> With perception as the connecting link between the driving situation and ultimate driving behavior its significance for safe driving is unmistakeable . . . No matter how organically perfect a person's sensory equipment may be, it does not necessarily follow that he will perceive the world around him accurately and realistically; neither does it follow that drivers with imperfect sensory apparatus will perceive the driving situation with a corresponding degree of inaccuracy . . . . If drivers fail to see the driving situation for what it is . . . they will cause an accident or be involved in one.[39]

The term "perception" is often misunderstood. Perception is the process of becoming aware of people, things, situations, and events and also the understanding of their meanings. The process involves such acts as observation, recognition, identification, and categorization.[40] Michaels[41] described perception as the transformation of environmental events into meaningful human information. Kingsley[42] related that perception was an active process, something that a person did. It was more than the simple gathering of sensations or a power of the mind, perception was a process by which sensations were transmitted to the brain and were made meaningful.

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[39] L. Brody and H. Stock, Highway Safety and Driver Education (New Jersey: Prentice-Hall, Inc., 1954), pp. 86-87.

[40] L. Crow and A. Crow, An Outline of General Psychology (New Jersey: Littlefield, Adams and Company, 1961), pp. 93-94.

[41] R. Michaels, "Human Factors in Highway Safety," Traffic Quarterly, XV, 4 (October, 1961), p. 592.

[42] H. Kingsley, The Nature and Conditions of Learning (New York: Prentice-Hall, Inc., 1946), p. 261.

Quensel described perception as follows:

> Perception is much more than efficient use of the senses, it is a process that has to do with awareness and comprehension of data transmitted from one's physical and social environment . . . . Perception is a process which involves the mind and the senses; the brain must select and interpret the sensory data before it becomes meaningful or useful. The art of perceiving something may be described in the following way. First, you give attention to some object, event or circumstance outside your own mind. Then your senses send impressions to the brain where they are registered, and for all practical purposes may be thought of as a picture. With continued perception the pictures are interpreted and become meaningful to us.[43]

The importance of perception as a factor in driving has emerged in recent years from human factors engineering and systems analysis.[44] McCormick stated:

> A man-machine system can be defined as an operating combination of one or more men with one or more equipment components, interacting to bring about, from given inputs (perceptions) some desired outcome within the constraints of a given environment.[45]

These components in driving were drivers, vehicles and roadways. Their interactions were traffic situations. Man's role as a driver within the system has been described as follows:

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[43] Quensel, op. cit., p. 7.

[44] R. McFarland, "Psychological and Behavioral Aspects of Automobile Accidents," Traffic Safety Research Review, XII, 3 (September, 1968), pp. 71-80; J. O'Day, "Systems Analysis and the Driver," Driver Behavior Cause and Effect, (Washington, D.C.: Insurance Institute for Highway Safety, 1968), pp. 83-99.

[45] E. McCormick, Human Factors Engineering (New York: McGraw Hill, 1964), p. 7.

> He must make skilled and properly timed actions, under varying road and traffic conditions, based on sound judgments and decisions: these decisions are, in turn, dependent upon previously acquired knowledge and the gathering of accurate information pertinent to the immediate traffic situation.[46]

Ross[47] described the task of the driver in two parts: the obtaining of accurate information concerning the relationship of his vehicle to the roadway, i.e., accurate perception and the performance of appropriate actions with these perceptions as a basis. Also depicted was the social aspect of the driving task; that is, the performance of the control functions in the presence of and in combination with many other vehicle-driver combinations.

The driver was characterized by Briggs[48] as an information processor who detected varied visual, auditory and proprioceptive stimuli and processed them in order to effect appropriate movements of the driver controls: the steering wheel, accelerator and brake pedals. This description of the driving task was similar to other descriptions concerning the place of perception in driving. This importance could not be overstated as it was apparent

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[46] W. Quensel, "A Concept of the Driving Task," Unpublished writings on driving task.

[47] H. Ross, "Schematic Analysis of the Driving Situation," Traffic Safety Research Review, IV, 3 (September, 1960), pp. 4-7.

[48] G. Briggs, "Driving As A Skilled Performance," Driver Behavior Cause and Effect (Washington, D.C.: Insurance Institute for Highway Safety, 1968), pp. 123-143.

that adequate and efficient perception was basic to proper driver performance.

Human perception is governed by several general principles. A discussion of some of these principles will establish the role of perception in human performance.

Perception is a selective process. At any given time our senses are exposed to an infinite number of stimuli, any one of which could elicit a response. We are only aware of a very small number of these stimuli because we learn to sort and organize data according to our goals, previous experiences, and our emotional state at the time.[49]

Bahrick[50] reported that when the incentives for responding to stimuli in a certain manner are high, individuals tend to perceive only those aspects of stimuli which were relevant to gaining the incentive. Under low motivation, stimuli which were irrelevant would also be perceived. In other words, the higher the motivation, the more selective of stimuli a person was.

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[49]L. Brody, "Teaching Perceptual Skills," Safety Education Digest, Driver Education, New York University, 1957, pp. 33-37.

[50]H. Bahrick, et al., "Effects of Incentives Upon Reactions to Peripheral Stimuli," Journal of Experimental Psychology, 44 (1952), pp. 400-406.

Platt Commented:

> Usually there are a number of continuous events occurring simultaneously, and the driver's attention is divided among them in proportion to their relative importance to him. It can be assumed that a person's sensory processes are all receiving general stimuli simultaneously. They pick up cues from continuous events and bring certain ones to attention. The driver's mind inspects them, and deals with them or discards them.[51]

One explanation of the selection process was advanced by Bloomer. He stated that "people tend to perceive everything except those elements which they do not want to perceive." This was called perceptual vigilance. The opposite phenomonon was labeled perceptual defense and it occurred when people "select certain important elements to perceive and basically ignore the rest."[52]

An example of perceptual defense was reported by Ericksen.[53] Using a group of subjects who could not successfully complete a task and another group who were always successful, it was found that when anagram words associated with the failure of one group were presented, they were less readily recognized than some neutral words.

Since perception involved the higher mental processes, it took time. If a situation was unfamiliar to an

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[51]F. Platt, "Operational Analysis of Traffic Safety," International Road Safety and Traffic Review, VI, 2 (Spring, 1958), p. 10.

[52]R. Bloomer, "Perceptual Defense and Vigilance, and Driving Safety," Traffic Quarterly (October, 1962), p. 550.

[53]C. Ericksen, "Psychological Defenses and 'Ego Strength' in the Recall of Completed and Incompleted Tasks,"

individual, perception would take a longer period--the more complex the situation the more time a person must have to carry out his decisions.[54] But if an individual was "set" to perceive or knows what he was to look for, the perception time required was cut to a minimum.[55] However, if the "pattern of expetancy" was incorrect, the perceptual process was slowed.[56]

In theory, a human being could pay attention to only one thing at a time.[57] Even though we could shift his attention very rapidly between a number of stimuli, there was a limit to the number of perceptions that he could make within a given time period.[58]

Within the task of the driver, the role of visual perception was of unmistakeable importance.

Journal of Abnormal and Social Psychology, 49 (1954), pp. 45-50.

[54]United States House Document No. 93, The Federal Role in Highway Safety (Washington, D.C.: U.S. Government Printing Office, 1959), p. 31.

[55]B. Maher, Principles of Psychopathology (New York: McGraw-Hill, 1966), p. 62; W. Quensel, "Teaching Perception in Driver Education," ADEA News and Views, 3, 2 (May, 1963), pp. 6-7.

[56]Baker, J., "Driver Characteristics and Freeway Accidents," Traffic Digest and Review (November, 1959), pp. 809.

[57]A. Combs and D. Snygg, Individual Behavior: A Perceptual Approach to Behavior (New York: Harper and Row, 1959), p. 204.

[58]Platt, op. cit., pp. 10-11.

Dr. Melvin D. Wolfberg commented:

> The improved automobile and highways that compose today's driving situations have left the task of driving to one nearly exclusive requirement--the need to see. It must be the business of every driver to see effectively, quickly, and accurately--to see everything necessary for safe driving--because ninety per cent of driving situations are based on vision.[59]

Michaels[60] reported that the driver must operate his vehicle based on his perceptions. He identified two classes of behavior which the driver must perform: guidance and control. Guidance, as used by Michaels, was a visual perception task composed of the search for and identification of hazards in the traffic scene.

Since the mid 1950's an extensive public service campaign to inform the public about visual perception and its importance in driving has been supported by the Ford Motor Company. In their two booklets "The Eyes Have It,"[61] and "Seeing Habits For Expert Drivers,"[62] Harold L. Smith and his associates stressed that the good driver builds a few selective seeing habits which

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[59]M. Wolfberg, "Vision and Its Effects," National Safety Council Transactions, Chicago, Illinois, XIV (October, 1968), p. 53.

[60]Michaels, op. cit., pp. 586-599.

[61]H. Smith, J. Cummings, and R. Sherman, The Eyes Have It (Dearborn, Michigan: Ford Motor Company, Educational Affairs Department, 1957), 12 pgs.

[62]Traffic Safety and Highway Improvement Department, Seeing Habits For Expert Driving (Dearborn, Michigan: Ford Motor Company, Educational Affairs Department, 1959), 27 pgs.

allow him to pay attention to the key details of the traffic scene while resisting the distractions which often lead to traffic conflicts. They stressed that driving was a full time job and that seeing correctly was what separated the good driver from the poor driver. The five step "Smith System" was widely known as an easy prescription towards better visual habits in driving.

The widespread use of traffic simulation has also pointed to the importance of visual perception within the driving task. Another type of simulation, different from the 16mm programmed films employed in driving simulators, were the training filmstrips "Perception of Driving Hazards."[63] These filmstrips used a tachistoscopic-type presentation to attempt to increase the recognition skills which drivers needed to identify potentially dangerous traffic situations.

Schlesinger[64] reported on still another method of simulation. He required drivers to name in a sequential order the cues generated by moving objects, stationary objects and traffic controls presented in a film. This was essentially the same as the commonly used technique

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[63]Shell Oil Company, Perception of Driving Hazards, Parts I, II, and III, Center for Safety Education, Shell Traffic Safety Center, New York University, New York (filmstrips).

[64]L. Schlesinger, "Quantitative Measurement of Driving Skills," National Safety Council Transactions, Chicago, Illinois, XXIII (October, 1964), p. 75.

in driver education called "commentary driving."[65] This technique required the driver to comment on the hazards he perceived and his actions to reduce them.

Significant studies have been completed to show that driving simulation is important and beneficial to safe driving. Much of the early research, performed in the military services, was concerned with tasks which were very similar to those found in driving.[66]

Recently, McPherson[67] used three groups: Low IQ (55-77), average IQ (93-112), and high IQ (120-128), to ascertain if the perception of traffic hazards was dependent upon IQ level. The experimental groups received traffic simulation training for ten instructional periods during which nine programmed instructional films selected from the Allstate Good Driver Library were used. He found that all groups improved significantly in their abilities to perceive traffic hazards, with the high group (IQ 120-128) showing the most improvement.

Gustafson[68] found that the Allstate Good Driver Trainer was effective in teaching beginning drivers the

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[65] G. Carmichael and E. Hugunin, "Experiment in Commentary Driving," Traffic Digest and Review, IV (1956), pp. 14-16.

[66] Fox, op. cit., pp. 10-33.

[67] McPherson, op. cit., pp. 22-27.

[68] R. Gustafson, "A Study to Compare the Effectiveness of Instruction in the Allstate Good Driver Trainer and On the Multiple Car Off-Street Driving Range With the Multiple Car Off-Street Driving Range" (unpublished doctoral dissertation, Michigan State University, 1965).

skills of driving, while Nolan[69] found that the Aetna Drivotrainer was also effective.

The relationship of the methods employed by the driving simulation instructor and the increase in the perception of traffic hazards was the object of an investigation by Dorner.[70] One group of students in this study were taught by an "Active" teacher, that is, one who pointed out to the students the cues and hazards present in the programmed films used in the simulators. The other group of students relied entirely upon the instructions given within the films while the teacher "passively" observed. Dorner found that when the "Active" method was employed, the student improvement in the perception of traffic hazards was significantly greater than when the "passive" treatment was administered.

Robinson[71] attempted to determine if the perception of traffic hazards could be developed efficiently in a typical classroom setting. He used two student groups: one viewed programmed instructional films in a classroom, the other received instruction using the Allstate Good

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[69]R. Nolan, "A Comparative Study of the Teaching Effectiveness of the Multiple Car Off-Street Driving Range and the Aetna Drivotrainer" (unpublished doctoral dissertation, Michigan State University, 1965).

[70]Dorner, op. cit., pp. 7-8.

[71]Robinson, op. cit., pp. 24-25, 35-37.

Driver Trainers. He found that both groups improved significantly in visual perceptual capabilities. Also the group which viewed the films in the classroom setting was not significantly different in visual perceptual abilities when compared with the group taught in the simulators.

A tachistoscope and slides were used by Streeter[72] to investigate the effects of visual training on the development of visual perceptual abailities as related to traffic. The training consisted of 35mm slides flashed on a screen for varying lengths of time ranging from one-half second to five seconds. The slides contained a series of numbers, traffic signs, and traffic scenes. He found that the perception of traffic hazards was significantly improved after training. (A "T" value of 6.86 was attained and a value of 3.46 was significant at the .0005 level.)

In a similar study, Barry[73] found that the traffic related visual perceptual abilities of emotionally disturbed or socially maladjusted children could be significantly improved with visual training.

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[72]Streeter, op. cit., pp. 16-26.

[73]M. Barry, "Development of Visual Perceptual Capabilities Among Emotionally Disturbed/Socially Maladjusted Students" (unpublished master's thesis, Illinois State University, 1969).

The importance of visual perception has been firmly established as a critical factor within the driving task. Several studies shall now be reported to describe the differences between good drivers and poor drivers concerning this essential factor.

Kephart[74] reported on a recent study conducted in Indiana:

> It is interesting to note that in many cases of 'routine' type accidents, unsuspected perceptual errors were present. When the drivers were questioned as to what they perceived in the few seconds just preceding an accident, it is amazing how many were unaware of important factors such as other vehicles, obstructions, etc. The troopers themselves expressed surprise at how grossly unaware the drivers confessed themselves to have been. It is felt that these protocols offer important evidence of the significance of perceptual alertness in automobile driving.

Smith[75] reported that it was possible to determine accident-producing drivers from accident-free drivers by their methods of observing the driving scene. The poorer drivers gave too much time to vehicular control, personal thoughts, events inside the vehicles and non-driving stimuli such as scenery.

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[74] N. Kephart, "Preliminary Study of Perceptual Factors in Highway Accidents," as reported by R. Sherman in "Seeing Habits and Vision, A Neglected Area in Traffic Safety," Traffic Quarterly, XV (October, 1961), p. 612.

[75] Smith and Cummings, op. cit., pp. 7-13.

Spicer[76] conducted a study to determine if there was any consistent relationship between attitudes, problem solving ability, frustration response, and visual perception of drivers. Spicer measured the subjects' visual perception by using eleven traffic scenes in 16mm silent motion pictures. These scenes depicted typical highway and city traffic conditions in Honolulu, Hawaii. A checklist was created, based on the responses of professional drivers. Of the original twelve items, eight were considered essential for safe driving and had positive weight values, while four concerned items which did not appear in the film. These had a negative weighting.

The test was first administered to a sample of college students and a reliability coefficient of .81 was obtained. However, an item analysis of each scene was made to determine the ability of each scene to discriminate between accident-repeaters and accident-free drivers. The results demonstrated that the checklist was ineffective and a revision was made. The positive weightings remained unchanged, but the number and magnitude of the negative weightings increased.

The revised test was then administered to a sample of 209 professional drivers. The visual perception

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[76]R. Spicer, "Human Factors in Traffic Accidents," Department of Health, Hawaii, 1963.

portion of the test was the only measure which significantly differentiated the accident-free drivers from the accident-repeaters in this group. The test was also administered to a group of non-professional drivers drawn from the State Health Department and the Honolulu Police Department. Again, the visual perception variable was the only one of the four which distinguished the drivers with poor records from those with good records.

Finally, a group of 875 teen-age applicants for a driver's license were used as a group for a study once the test was modified for use with the adolescent driver. All the subjects were fifteen, sixteen or seventeen years of age, and had applied for a driver's license at the Honolulu Police Department between July 1, 1962, and September 7, 1962. An elaborate follow-up system was devised to enable the identification of all individuals who took part in the study and their subsequent involvement in reportable accidents. The records of accident-free drivers and accident-involved drivers were compared. The results indicated that the visual perception scores of the accident-involved group were significantly different from those of the accident-free group. On the basis of this study, Spicer concluded that visual perception appeared to be a critical factor in driving.

Summary

The factors of psychological, personal and social adjustment of individuals as well as their ability to perceive accurately and efficiently have been shown to be important in driving of an automobile.

The adjustment of an individual to himself, others and society was a significant factor in his involvement in traffic collisions. The results of psychometric tests have demonstrated a strong relationship to eventual driving records.

The role which visual perception played in automobile driving was extremely important. Simulation of several types has been used to develop the process of visual perception. It has been demonstrated that visual perception was one of the most critical factors in driving when accident involvement was studied.

CHAPTER III

DESIGN AND METHODOLOGY

Test Instruments

The "Perception Test" consisted of fifteen 35mm slides which were selected from the "Perception of Driving Hazards, Parts I, II and III" filmstrips produced by the Shell Oil Company in conjunction with the Center For Safety Education of New York University. These filmstrips were originally designed for driver education classes to assist in the training of visual perceptual abilities through time-limited exposures to traffic scenes. However, the Center For Safety Education has stated that the filmstrips have demonstrated value when used with many types of people and drivers including chronic violators.[77]

The "Perception Test" was developed at Illinois State University as an informal instrument for the purpose of evaluating visual perceptual abilities. The slides within the test depicted typical driving environments encountered by most drivers including residential, urban,

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[77]Center For Safety Education, A Guidebook for Effective Use of the Filmstrip Perception of Driving Hazards, New York University, New York, p. 1.

expressway and highway traffic situations. Each slide was analyzed by the instructional staff of the Traffic and Safety Education section of Illinois State University for the purpose of identifying the apparent hazards, the potential hazards and other traffic clues necessary for the safe and efficient operation of a motor vehicle. Within the test itself, certain checks, pseudohazards, were constructed to prevent a subject from guessing and also to determine if the traffic scene was being interpreted correctly.

The identified hazards and pseudohazards were numerically weighted according to their degree of visibility and to the extent to which they presented a hazard to the driver. The hazards present were assigned positive values ranging from +1 to +3, while the pseudohazards were assigned negative values of -2 and -3 since they had to be more discrete in order to be worthwhile as distractors. The sum total of the positive values was +72, and the sum total of the negative scores was -41. The subject's visual perceptual ability score or total adjusted score was determined by adding the positive and negative totals.

During the administration of the test, a multiple choice answer sheet was used. The subject was instructed to place an "X" on the answer sheet next to the choice(s) (A, B, C, D, or E) which he felt represented a hazard

within the traffic scene previously viewed for five seconds (Appendix A). Choices were presented by means of a pre-recorded audiotape which was used to eliminate any variations in voice or facial expressions of the examiner. The vocabulary incorporated within the choices was controlled in order to make it as understandable as possible for all drivers. An attempt was made to limit the length of memory span required between the visual presentation and the audio-responses by having no more than five possible choices per slide.

The "Perception Test" has been used on several occasions. After pilot tests had been given to students in several Illinois high school and college Driver Education classes, the test was employed in a number of research projects. Several have been cited previously.[78] On the basis of these research projects, the expertise used in the development of the filmstrips frames from which the slides were taken, and other work undertaken by this author, it appeared that the "Perception Test" was a valuable instrument for determining the traffic related visual perceptual capabilities of subjects.

The "Inventory" was a personality inventory consisting of sixty-three items which attempted to measure an individual's feelings toward himself, others and established

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[78] McPherson, Dorner, Streeter, Barry, and Robinson, op. cit.

social conventions. Responses to the items in the "Inventory" were expressed by checking one of five choices--always, usually, sometomes, rarely, or never.

The present form of the "Inventory" (Appendix B) is a modification of an original one hundred items selected on the basis of face validity by Dr. William A. Mann of Michigan State University's Highway Traffic Safety Center. The original one hundred items represented a compilation of the feelings of one hundred high school students who were characterized by their high school driver education teachers as the worst drivers in their schools. The students were interviewed and case studies were made to ascertain the students' feelings toward the police, school, cars, family, society, their peers and personal expectations, desires and habits.

Twenty central Michigan driver education teachers were then asked to evaluate students in their classes as a continuing part of the study. These teachers used the following categories in classifying the students:

1. Very aggressive: Any student who, in the opinion of the driver education instructor through personal observation in the classroom and/or during practice driving instruction, displays behavior that is exceedingly aggressive, is a show-off, is extremely egotistical or tempermental.

2. Very Reserved: Any student who, in the opinion of the driver education instructor through personal observation in the classroom and/or during practice driving instruction, displays behavior which is exceedingly cautious and timid.

3. Average: All students who do not fall into either of the other classifications.79

After this classification, the "Inventory" was administered to 451 students with the following results: eighty students were classified as Very Aggressive, eighty-six classified as Very Reserved, and 285 as Average. As a result of this study, thirty-seven items from the original one hundred items were deleted because almost all students answered in the same manner. Using the 85th percentile of the responses of the Average group to the remaining sixty-three items an adjustment scale was developed. The deviation of this response pattern was 7-19 points.

Kenel used the "Inventory" in its present form, in the Ingham County Driver Safety School, Lansing, Michigan, with forty-two referred individuals with the following results:

> Using the criteria previously established, 15 persons were identified as very reserved, 21 as very aggressive and four as average. The two remaining individuals scored four and five of six lie items incorrectly and deviated by 46 points each on the adjustment scale. Their response to significant items vacillated from marked aggression to very reserved.80

79J. Schaff, "Personal Attitude Survey" (unpublished Master's Thesis, Michigan State University, 1957).

80Kenel, op. cit., p. 32.

He continued:

> Observation tends to indicate, however, that greater discrimination of behavior is required than that employed in the initial efforts, namely Very Aggressive, Very Reserved, and Average. As a result . . . the following six categories of behavior (were used):
>
> 1. Behavior characterized by well adjusted interaction with persons and consistent with the norms of the society in which the individual lives.
>
> 2. Behavior generally characterized by satisfactory interaction with persons and society, but with periodic withdrawal from contact with people.
>
> 3. Behavior generally characterized by satisfactory interaction with persons and society, but with periodic efforts toward assertive action.
>
> 4. Behavior characterized by forceful, outgoing action or vigorous efforts to assert oneself over others.
>
> 5. Behavior characterized by withdrawal from contact with other persons.
>
> 6. Behavior characterized by a pendulum effect, vacilatting between extremes of aggression and withdrawal.[81]

Using the "Inventory" with a large number of high school driver education students (1,057), Kenel reported that observed behavior and responses to the Inventory were significantly related as was the subsequent driving performance. The reliability and validity of the "Inventory" were established by Kenel:

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[81] Ibid., pp. 32-33.

> The reliability of the Mann Inventory was determined by application of product-Moment coefficient of correlation to two separate administrations of the instrument. Correlation values of .697 - .986 were derived, with 63 degrees of freedom these values indicate a high to very high correlation with marked or dependable relationships . . . . As the individuals behavior deviated from category 1 (well-adjusted) toward category 6 (marked evidence of problems of adjustment in school), his driving record of convictions and/or collisions increased.[82]

Based upon the above research, it was felt that the "Inventory" could be a very useful instrument for identifying the behavior patterns of drivers.

Sample

The sample population for this study consisted of 494 subjects who were enrolled in Driver Education at the following high schools in Lansing, Michigan: Eastern High School, Everett High School, and Sexton High School; and at East Lansing High School in East Lansing, Michigan. These four high schools (approximately 1,500 - 2,000 students each) comprised all of the public high schools in the two cities, thus it was possible to obtain a sample population which represented all socio-economic, ethnic, and cultural groups in the communities.

The number of students included from each high school was not equal since the number of students in each driver education program varied. The days on which

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[82] Ibid., p. 72.

the test instruments were administered in each school were selected to preclude the effects of the visual training which was to be received in the driver education classes. The tests were administered on September 30, October 1, 2, 9 and 10, 1969. Only those students who were present on the selected days were included in the sample population. The students ranged in age from seventeen years ten months to fifteen years four months, with the majority being approximately sixteen years of age. Each school was represented by the following number of students: Eastern High School, 129 students; Everett High School, 115 students; Sexton High School, 116 students; and East Lansing High School, 134 students.

The driver education programs at the various schools were similar. All of the programs extended over an eighteen week semester and each school offered the entire program, both laboratory and classroom, concurrently during the regular school day. Most of the students in the sample population had received some behind-the-wheel experience, but no one exceeded one hour of training at the time of testing. All of the students had received instruction in the "Smith System" or "Seeing Habits For Expert Drivers," but very little other visual training, if any. The students from East Lansing High School had received two lessons in the simulator; however, these films were not visual

training films. The students from Eastern High School had received two lessons on the Drivocator,[83] but these lessons were directed more towards information acquisition than visual training. The students at East Lansing High School, Sexton High School, and Everett High School had received some training on the driving range, but this did not exceed two hours for any one group.

Data

Two types of data were gathered from each subject: their responses to the slides in the "Perception Test" and their responses to the items in the "Inventory." Each of the test instruments was administered in the regular classroom setting for the respective schools with the "Perception Test" followed by the "Inventory." The students were requested to respond as honestly as possible to both test instruments and were assured that the results of neither would be used for grading or any other purpose besides the present research.

After scoring the "Inventory" each student was assigned to one of the six previously mentioned behavioral categories. The teachers at the high schools were asked to place each of the students into one of the six

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[83]Multi-media programmed instruction with student response devices, manufactured by Raytheon, Inc.

categories according to their observations of the students during the semester in the classroom or in laboratory. This rating by the teachers was made at a time when they felt they knew the students well enough to make such a categorization. This categorization usually occurred after approximately two and one-half months had passed in the semester. Any discrepancies in category placement between the "Inventory" and the teacher categorization were discussed with the teachers and further records consulted, when necessary, in an attempt to determine the basic behavior pattern.

The Null Hypotheses

The following are a restatement of the hypotheses of this study in the null form, i.e. stating that no significant relationships between the variables exist for the purposes of the statistical treatments.

$H_0 1$: There are no significant differences in the visual perceptual capabilities as measured by the Perception of Traffic Hazards Test of individuals in the six behavioral categories as determined by the Mann Inventory.

$H_0 2$: There is no significant positive difference in visual perceptual capabilities as measured by the Perception of Traffic Hazards Test of individuals in categories one, two and three as compared to individuals in categories four, five and six as determined by Mann Inventory.

$H_0 3$: There is no significant relationship between the total numerical score attained by an individual on the Perception of Traffic Hazards Test and the score on the adjustment scale of the Mann Inventory.

Analysis of The Data

The data obtained were analyzed using the following: a one-way analysis of variance, a t-test of significance, and a product-moment coefficient of correlation.

A one-way analysis of variance was employed to determine the differences between the responses of the individuals in the six behavioral categories and their responses to the visual stimuli, i.e. to determine if the scores achieved by individuals in each of the separate categories differed significantly from the individuals in the other categories. An .05 level of significance was used to determine the acceptance or rejection of this hypothesis ($H_0 1$).

A t-test for significance was employed to determine the significance of the difference between the mean test score on the "Perception Test" of the individuals in categories one, two and three and the mean test score on the "Perception Test" of the individuals in categories four, five and six. This was done to ascertain if any difference in visual perceptual capabilities occurred with the degree of overall adjustment of individuals. An .05 level of significance was used to determine the acceptance or rejection of this hypothesis ($H_0 2$).

The Pearson $\underline{r}$ product-moment coefficient of correlation was employed to determine the relationship of the total score attained by an individual on the

"Perception Test" to his score on the adjustment scale of the "Inventory." This was done to ascertain the relationship between the two test instruments. A correlation of .40 was required for the acceptance of this hypothesis. ($H_0 3$) this level of correlation was selected since Guilford has stated that a relationship of less than .20 showed a very slight relationship; from .20 to .40 demonstrated a low correlation; a substantial relationship for values from .40 - .70; and a high to very high relationship for values of .70 to .90 and .90 to 1.00.[84]

Summary

The sample population was drawn from the public high schools of Lansing and East Lansing, Michigan. Responses to the Mann Inventory and the Perception of Traffic Hazards Test were collected during the first five weeks of fall semester of the 1969-1970 school year. Each subject was then assigned to one of six behavioral categories and the results of the "Perception Test" analyzed.

An analysis of variance for an unequal number of observations in each category was employed to determine the significance of differences between categories on

[84] J. Guilford, Fundamental Statistics in Psychology and Education (New York: McGraw-Hill, 1950), p. 165.

the responses to the "Perception Test." An .05 level of significance was employed to determine the rejection or retention of the hypothesis.

A t-test for significance was used to determine if the difference on the "Perception Test" between categories one, two and three and categories four, five and six was significant. An .05 level of significance was employed to determine the rejection or retention of the hypothesis.

The product-moment coefficient of correlation was used to determine the relationship between the scores on the "Perception Test" and the scores on the adjustment scale of the "Inventory." A correlation of .40 was required for the acceptance of the coefficient.

CHAPTER IV

ANALYSIS OF RESULTS

The results of the analysis of the data are presented in this chapter. The analysis of the following are presented: (1) the differences in the visual perceptual capabilities of the individuals in each of the six behavioral categories, (2) the difference in visual perceptual capabilities of individuals characterized as reasonably well-adjusted when compared with those characterized by problems in adjustment, (3) the relationship between the visual perceptual capability measure of the "Perception Test" and the adjustment measure of the "Inventory."

Of the original 494 subjects in the sample population, a number of subjects were excluded from the analysis for one of two reasons: either both test instruments were not completed, or the results of the "Inventory" were such that no conclusive determination of the behavioral pattern could be made. The total number of subjects used in the statistical analysis was 465.

Table 1 presents the composition of the sample population by behavioral category. The numbers of individuals within each category are not equal. Categories

four, five and six have smaller numbers of individuals as these categories represent individuals characterized by problems in adjustment and therefore represent a small part of the population and sample.

TABLE 1.--Composition of sample population by behavioral category.

Category	Male	Female	Total
1	70	68	138
2	39	58	97
3	76	61	137
4	27	15	42
5	10	13	23
6	12	16	28
			465

Differences by Category: Responses to "Perception Test"

The following is the null hypothesis which was tested for each of the behavioral categories:

$H_0 1$: There are no significant differences in the visual perceptual capabilities as measured by the Perception of Traffic Hazards Test of individuals in the six behavioral categories as determined by the Mann Inventory.

Using an analysis of variance for an unequal number of observations in each category on the total positive score for each individual on the "Perception Test," a value of 0.51 was obtained for the F-statistic. The values reported for "Within Categories" were intermediate in the calculation of the F-statistic and were therefore reported in the table. A value of 2.23 was needed for significance at the .05 level. Table 2 represents the results obtained. On the basis of the data presented in Table 2, the null hypothesis of no significant differences between categories in visual perceptual capabilities must be retained.

The results of an analysis of variance for an unequal number of observations in each category on the total negative score for each individual on the "Perception Test" are presented in Table 3. The values reported for "Within Categories" were intermediate in the calculation of the F-statistic and were therefore reported in the table. An F-value of 2.23 was needed to demonstrate significance at the .05 level. An F-value of 0.60 was obtained; and therefore, the null hypothesis of no significant differences between categories in visual perceptual capabilities must be retained.

Table 4 contains the results of an analysis of variance for an unequal number of observations in each category on the total adjusted score for each individual on the "Perception Test." The value of the F-statistic

TABLE 2.--Analysis of variance of the total positive scores for all individuals on the "Perception Test".

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Square	F-Statistic	Level of Significance
Between Categories	155.81	5	31.16	0.51	.77
Within Categories	27990.50	459	60.98		
Total	28146.31	464			

TABLE 3.--Analysis of variance of the total negative scores for all individuals on the "Perception Test".

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Square	F-Statistic	Level of Significance
Between Categories	85.09	5	17.02	0.60	.70
Within Categories	13030.47	459	28.31		
Total	13115.56	464	28.39		

TABLE 4.--Analysis of variance of the total adjusted scores for all individuals on the "Perception Test"

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Square	F-Statistic	Level of Significance
Between Categories	113.13	5	22.63	0.38	.86
Within Categories	27444.09	459	59.79		
Total	27557.21	464			

obtained was 0.38; a value of 2.23 was needed to demonstrate significance at the .05 level. The values reported for "Within Categories" were intermediate in the calculation of the F-statistic and were therefore reported in the tables. On the basis of this obtained F-statistic value presented in Table 4, the null hypothesis of no significant differences between categories in visual perceptual capabilities must be retained.

After separating the sample population into male and female groups, similar analyses of variance for unequal numbers of observations in each category were made on the total positive, total negative and total adjusted scores for each individual on the "Perception Test." The results of these analyses of variance appear in Tables 5-10. The values reported for "Within Categories" were intermediate in the calculation of the F-statistic and were therefore reported in the tables.

For females (Tables 5-7) the following results were obtained: (1) an F-statistic value of 0.72 was obtained (Table 5); for the .05 level of significance an F-value of 2.26 was needed to demonstrate a significant difference for the total positive scores for females on the "Perception Test"; (2) an F-value of 1.16 was obtained for females on the total negative scores (Table 6); an F-value of 2.26 was required for

TABLE 5.--Analysis of variance of the total positive scores for females on the "Perception Test".

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Square	F-Statistic	Level of Significance
Between Categories	213.04	5	42.61	0.72	.61
Within Categories	13255.89	225	58.92		
Total	13468.94	230			

TABLE 6.--Analysis of variance of the total negative scores for females of the "Perception Test".

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Square	F-Statistic	Level of Significance
Between Categories	138.53	5	27.71	1.16	.33
Within Categories	5395.70	225	23.98		
Total	5534.23	230			

TABLE 7.--Analysis of variance of the total adjusted scores for females on the "Perception Test".

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Square	F-Statistic	Level of Significance
Between Categories	64.42	5	12.88	0.21	.96
Within Categories	13581.33	225	60.36		
Total	13645.75	230			

TABLE 8.--Analysis of variance of the total positive scores for males of the "Perception Test".

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Square	F-Statistic	Level of Significance
Between Categories	203.49	5	40.70	0.64	.67
Within Categories	14472.74	228	63.48		
Total	14676.24	233			

TABLE 9.--Analysis of variance of the total negative scores for males on the "Perception Test".

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Square	F-Statistic	Level of Significance
Between Categories	145.67	5	29.14	0.89	.49
Within Categories	7435.28	228	32.61		
Total	7580.96	233			

TABLE 10.--Analysis of variance of the total adjusted scores for males on the "Perception Test".

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Square	F-Statistic	Level of Significance
Between Categories	241.25	5	48.25	0.80	.55
Within Categories	13670.21	228	59.96		
Total	13911.46	233			

the determination of an .05 level of significance; (3) an F-statistic value 2.26 was needed to demonstrate significance at the .05 level; an F-value of 0.21 was obtained (Table 7) for the total adjusted scores.

On the basis of the results presented in Tables 5-7, the null hypothesis of no significant differences between categories on the "Perception Test" must be retained.

Using the male portion of the population, the results presented in Tables 8-10 were obtained.

Table 8 indicates an F-value of 0.64 for the total positive scores of males on the "Perception Test"; an F-value of 2.26 was needed to demonstrate significance at the .05 level. Table 9 indicates an F-value of 0.89 for the male portion of the sample on the total negative scores of the "Perception Test"; the F-value required for the .05 level of significance was 2.26. An F-value of 0.80 was indicated for the males on the total adjusted scores of the "Perception Test" as presented in Table 10; an F-value of 2.26 was required for the .05 level of significance.

On the basis of the results presented in Tables 8-10, the null hypothesis of no significant differences between categories in visual perceptual capabilities must be retained.

Differences by Overall Adjustment: Responses to "Perception Test"

The following is a restatement of the null hypothesis which was tested:

$H_0 2$: There is no significant positive difference in visual perceptual capabilities as measured by the Perception of Traffic Hazards Test of individuals in categories one, two and three as compared to individuals in categories four, five and six as determined by the Mann Inventory.

A t-test of significance between means was used to determine the significance of the difference between the two groups. The results of this test appears in Table 11.

A t-value of 1.65 was needed to demonstrate significance at the required .05 level; a value of 1.07 was obtained for the t-statistic. On the basis of this obtained t-value presented in Table 11, the null hypothesis of no significant difference between groups must be retained.

Relationship of Test Instruments

The following is a restatement of the null hypothesis which was tested for each of the individuals in this investigation:

$H_0 3$: There is no significant relationship between the total numeric score attained by an individual on the Perception of Traffic Hazards Test and the score on the adjustment scale on the Mann Inventory.

Several analyses of this hypothesis were made. Included were correlations of the total positive, total

TABLE 11.--T-Test for significant difference between individuals in categories one, two and three and individuals in categories four, five and six on the "Perception Test".

Categories	Sum of Squares	Mean Squared	N	Variance	t-Value
1, 2, 3	847.92	2224	373	49	1.07
4, 5, 6	222.31	2330	92	86	

negative, and total adjusted scores on the "Perception Test" with the adjustment scale score of the "Inventory" for all individuals regardless of behavioral category; for individuals in categories one, two and three; categories four, five and six; males; females; individuals with aggressive tendencies (categories 3 and 4); and individuals with withdrawal tendencies (categories 2 and 5).

The results of a product-moment correlation for each of the subjects in this investigation regardless of behavioral category are presented in Table 12. The variables used in this correlation were the adjustment score on the "Inventory," the total positive score, the total negative score and the total adjusted score for each individual on the "Perception Test."

A correlation coefficient of .40 was required for acceptance of the hypothesis. A correlation coefficient of -0.01 was obtained between the total adjusted score on the "Perception Test" and the score on the adjustment scale of the "Inventory." A value of 0.06 was obtained for the relationship between the total positive score on the "Perception Test" and the score on the adjustment scale of the "Inventory." The value of r for the total negative score on the "Perception Test" and the score on the adjustment scale of the "Inventory" was 0.10.

Based on the results presented in Table 12, the null hypothesis of no significant relationship between

TABLE 12.--Correlation between visual perception scores and adjustment scale scores for all individuals.

	Product-Moment Correlations		
Total Positive on PTHT	1.00		
Total Negative on PTHT	0.36	1.00	
Total Adjusted on PTHT	0.76	-0.32	1.00
Adjustment Scale	0.06	0.10	-0.01
	Total Positive	Total Negative	Total Adjusted

the visual perception score and the adjustment score as measured by the two instruments must be retained.

Table 13 contains the results of a product-moment correlation for the individuals in behavioral categories one, two and three. The variables used in this correlation were: the score on the adjustment scale of the "Inventory," the total positive, the total negative and the total adjusted score for each individual on the "Perception Test."

A value of 0.03 was obtained for the correlation of the score on the adjustment scale of the "Inventory" and the total positive score on the "Perception Test." A correlation coefficient of 0.14 was obtained for the relationship between the score on the adjustment scale on the "Inventory" and the total negative score on the "Perception Test." The value of r for the total adjusted score on the "Perception Test" and the adjustment scale score on the "Inventory" was -0.07.

A value of .40 was required for the acceptance of the hypothesis. On the basis of the results presented in Table 13, the null hypothesis of no significant relationship between the adjustment score and the visual perception score as measured by the two instruments must be retained.

The results of a product-moment correlation for the subjects in behavioral categories four, five and six

TABLE 13.--Correlation between visual perception scores and adjustment scale scores for individuals in categories one, two, and three.

	Product-Moment Correlations		
Total Positive on PTHT	1.00		
Total Negative on PTHT	0.38	1.00	
Total Adjusted on PTHT	0.75	-0.32	1.00
Adjustment Scale	0.03	0.14	-0.07
	Total Positive	Total Negative	Total Adjusted

are presented in Table 14. The variables used in this correlation were the score on the adjustment scale of the "Inventory," the total positive, the total negative and the total adjusted score for each subject on the "Perception Test."

A correlation of .40 was required for acceptance of the hypothesis. A correlation coefficient of 0.08 was obtained for the relationship between the score on the adjustment scale of the "Inventory" and the total positive score on the "Perception Test." A value of -0.00 was obtained for the correlation coefficient of the adjustment scale score of the "Inventory" and the total negative score on the "Perception Test." The value of r for the total adjusted score on the "Perception Test" and the score on the adjustment scale of the "Inventory" was 0.08.

On the basis of the findings presented in Table 14, the null hypothesis of no significant relationship between the adjustment score and the visual perception score as measured by the two instruments must be retained.

The population was divided according to sex and a product-moment correlation was performed. The results of this analysis are presented in Tables 15 and 16. The variables used in the correlations were the score on the adjustment scale of the "Inventory," the total positive,

TABLE 14.--Correlation between visual perception scores and adjustment scale scores for individuals in categories four, five and six.

	Product-Moment Correlations		
Total Positive on PTHT	1.00		
Total Negative on PTHT	0.27	1.00	
Total Adjusted on PTHT	0.79	-0.33	1.00
Adjustment Scale	0.08	-0.00	0.08
	Total Positive	Total Negative	Total Adjusted

TABLE 15.--Correlation between visual perception scores and adjustment scale scores for females in all categories.

	Product-Moment Correlations		
Total Positive on PTHT	1.00		
Total Negative on PTHT	0.31	1.00	
Total Adjusted on PTHT	0.79	-0.31	1.00
Adjustment Scale	0.05	0.12	-0.04
	Total Positive	Total Negative	Total Adjusted

TABLE 16.--Correlation between visual perception scores and adjustment scale scores for males in all categories.

	Product-Moment Correlations		
Total Positive on PTHT	1.00		
Total Negative on PTHT	0.39	1.00	
Total Adjusted on PTHT	0.73	-0.33	1.00
Adjustment Scale	0.08	0.09	0.01
	Total Positive	Total Negative	Total Adjusted

the total negative and the total adjusted score for each individual on the "Perception Test."

Table 15 represents the findings for the female subjects in the sample population.

A correlation of .40 was required for the acceptance of the hypothesis. A correlation coefficient of 0.05 was obtained for the relationship between the score on the adjustment scale of the "Inventory" and the total positive score on the "Perception Test." The value of r for the relationship between the total negative score on the "Perception Test" and the adjustment scale score on the "Inventory" was 0.12. A value of -0.04 was obtained for the relationship of the total adjusted score on the "Perception Test" and the score on the adjustment scale of the "Inventory."

On the basis of the findings presented in Table 15, the null hypothesis of no significant relationship between the adjustment scale score and the visual perception score as measured by the two instruments must be retained.

Table 16 represents the findings for the male subjects in the sample population. A correlation of .40 was required to demonstrate a significant relationship between the variables.

A value of 0.08 was obtained for the relationship of the total positive score on the "Perception Test" and the adjustment scale score of the "Inventory." The

correlation between the total negative score on the "Perception Test" and the score on the adjustment scale of the "Inventory" was 0.09. The value of *r* for the relationship between the total adjusted score on the "Perception Test" and the adjustment scale score on the "Inventory" was 0.01.

Based on the findings presented in Table 16, the null hypothesis of no significant relationship between the adjustment scale score and the visual perception score as measured by the two instruments must be retained.

The relationships of the categories with aggressive tendencies (categories 3 and 4) and the categories with withdrawal tendencies (categories 2 and 5) to the visual perception score are presented in Tables 17 and 18. The variables used in this correlation were the score on the adjustment scale of the "Inventory," the total positive, the total negative and the total adjusted score on the "Perception Test." A correlation of .40 was required for the acceptance of the hypothesis.

Table 17 presents the findings for behavioral categories 3 and 4. The coefficient of correlation for the total positive score on the "Perception Test" and the adjustment scale score on the "Inventory" was 0.01. The value of *r* for the relationship between the score on the adjustment scale of the "Inventory" and the total

TABLE 17.--Correlation between visual perception scores and adjustment scale scores for individuals in categories three and four.

Product-Moment Correlations			
Total Positive on PTHT	1.00		
Total Negative on PTHT	0.25	1.00	
Total Adjusted on PTHT	0.79	-0.40	1.00
Adjustment Scale	0.01	0.05	-0.03
	Total Positive	Total Negative	Total Adjusted

TABLE 18.--Correlation between visual perception scores and adjustment scale scores for individuals in categories two and five.

	Product-Moment Correlations		
Total Positive on PTHT	1.00		
Total Negative on PTHT	0.42	1.00	
Total Adjusted on PTHT	0.75	-0.24	1.00
Adjustment Scale	0.09	0.12	0.01
	Total Positive	Total Negative	Total Adjusted

negative score on the "Perception Test" was 0.05. A value of -0.03 was obtained for the relationship between the total adjusted score on the "Perception Test" and the adjustment scale score of the "Inventory."

On the basis of the findings presented in Table 17, the null hypothesis of no significant relationship between the adjustment scale score and the visual perception score as measured by the two instruments must be retained.

The findings for behavioral categories 2 and 5 are presented in Table 18.

A value of 0.09 was obtained for the relationship between the total positive score on the "Perception Test" and the adjustment scale score of the "Inventory." The coefficient of correlation between the total negative score on the "Perception Test" and the score on the adjustment scale of the "Inventory" was 0.12. The value of r for the relationship between the total adjusted score on the "Perception Test" and the adjustment scale score on the "Inventory" was 0.01.

On the basis of the findings presented in Table 18, the null hypothesis of no significant relationship between the score on the adjustment scale and the visual perception score as measured by the two instruments must be retained.

Summary

Statistical analysis of the data revealed:

1. When subjects were grouped on the basis of behavioral categories, no significant differences existed with respect to visual perceptual capabilities. Further analysis of male and female subjects within the behavioral categories also revealed no significant differences between categories. The separate analyses were made using the total positive, the total negative and the total adjusted scores on the "Perception Test." The values of the obtained F-statistic ranged from 0.21 to 1.16, none of which revealed significance.
2. When the subjects were grouped according to overall adjustment (categories 1-3 and categories 4-6), no significant difference existed in the visual perceptual capabilities.
3. The relationship between the adjustment scale score and the visual perception score was near zero. The coefficient of correlation using the total positive score on the "Perception Test" ranged from 0.01 to 0.09; for the total negative scores, from -0.00 to 0.14; for the total adjusted scores, from -0.07 to 0.08.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The primary purpose of this study was to investigate the relationship between visual perceptual capabilities and behavioral categories. An attempt was made to determine if individuals classified into distinct behavioral categories using the Mann Inventory would respond differently to the items in the Perception of Traffic Hazards Test.

A secondary purpose of this investigation was to determine whether or not there was a relationship between the two test instruments.

The public high schools of Lansing and East Lansing, Michigan, were selected for this investigation for several reasons. Among these were:

1. The student bodies represented the broad spectrum of socio-economic, ethnic, and cultural groups within the communities.
2. The availability of cooperative and qualified, professional teachers in each of the driver education programs.

The test instruments were administered during the first five weeks of the eighteen week driver education programs in the respective schools during the fall of 1969. The days selected to administer the test instruments were arbitrarily selected. On the basis of the results of the "Inventory," confirmed by teacher observation, each of the students was placed into one of six behavioral categories. The results of the "Perception Test" were then analyzed.

The hypotheses were tested using a one-way analysis of variance, a t-test for significance and a product-moment correlation.

Conclusions

The following are the conclusions based upon the findings from this investigation.

1. No significant differences existed between individuals in the six behavioral categories with regard to visual perceptual capabilities. The findings showed no significant differences existed when the total positive or total negative components of the visual perception score or the total adjusted test scores were analyzed. The F-statistic value for five degrees of freedom was .51; and F-value of 2.23 was needed to demonstrate significance at the required .05 level.

2. No significant difference in visual perceptual capabilities existed between individuals with regard to overall adjustment. The findings demonstrated no significant difference existed for individuals in categories one, two and three when compared to individuals in categories four, five and six. A t-test value of 1.07 was obtained. A t-value of 1.65 was needed to be significant at the .05 level.
3. The correlation between the test instruments was very low. The correlation coefficient between the total adjusted visual perception score and the adjustment scale score was -0.01.
4. There were no significant differences on the variables measured on the basis of sex. The results of both the analyses of variance and the correlations using female and male divisions were very similar at non-significant levels.

Discussion

The findings in this investigation showed no significant differences between behavioral categories with regard to visual perceptual capabilities. However, this does not negate the importance of differences in behavior and/or visual perception in driving. Several observations can be made.

One factor which was not directly measured by the "Perception Test" may tend to explain some of the findings in this investigation. Within the process of perception, interpretations must be made by a driver concerning the hazards and risk involved in a specific traffic situation. Individuals within each of the behavioral categories had different emotional and psychological abilities and inclinations in handling traffic situations. These differences may not have been apparent in the measuring of visual perceptual capabilities using the "Perception Test," and might therefore tend to explain the low correlation with the "Inventory." These differing emotional and psychological predispositions have been shown to be major factors in poor driving records. Therefore, since the "Inventory" has been shown to be an effective predictor of future driving records, and since the correlation between the two test instruments was low, it would appear that there would be a substantial predictive value in using the "Perception Test" separately in attempting to predict future driving records for individuals similar to this sample population.

While not at a significant level, subjects who exhibited withdrawal tendencies (categories 2 and 5) tended to over-react to the visual stimuli presented and seemed to see things which were not present. The means of the total negative scores on the "Perception

Test" of categories 2 and 5 were 6.60 and 7.96 respectively as compared to the means of categories 3 and 4 (aggressive tendencies) which were 6.12 and 5.88 respectively. It might be surmised that the individuals in categories 2 and 5 may have experienced more anxiety about the test due to past problems of performance in school, and having a strong desire to perform well would tend to make more incorrect responses.

It has been demonstrated that visual perceptual capabilities could be significantly increased with training. It has also been shown that the behavioral patterns of an individual as expressed in the "Inventory" are significantly related to the eventual driving record. However, it has not been determined if an increase in visual perceptual capabilities would be able to compensate for behavioral patterns which lead to violations and collisions. In other words, even though behavioral patterns as expressed in the "Inventory" are very resistant to change, it may be possible to compensate for them by increasing the visual perceptual capabilities of individuals.

It appears that there would be an additive factor in prediction when both test instruments are used, since the correlation between them was essentially zero. The "Inventory" has been shown to be an accurate predictor of future driving records, but when combined with the

"Perception Test" it appears that there would be a gain in predictive value. Moreover, if the test instruments were readministered at the end of the subjects' formal training, significant differences might appear; and hence, more predictive power might be attained.

Since both the variables treated in this study are extremely important for driving, the findings have some implications for driver education programs. The correlation between the two test instruments was extremely low. This would tend to indicate that two different areas were being measured; and therefore, that both of these areas would need to be treated separately within driver education programs. In fact, it is possible that levels of competency in visual perceptual capabilities should be established as a criterion for successful completion of driver education. Also instructors must be aware of the behavioral patterns of their students if they are to do an effective job in advancing the students' abilities.

Recommendations

1. A follow-up of the 465 drivers included in this investigation to determine if the visual perceptual capabilities change with the acquisition of formal training and/or driving experience.

2. A study to determine if drivers identified as problem drivers differ in visual perceptual capabilities as measured by the "Perception Test."
3. Driver Education teachers should develop and measure acceptable criterion levels of visual perceptual capabilities for students in their programs.
4. The development of a dynamic visual perceptual measure for traffic situations.
5. The visual perceptual training of individuals in each of the different categories to ascertain if the subsequent driving records differ from another group which was untrained.
6. The correlation of the "Perception Test" with another measure of visual perceptual capabilities.
7. The replication of this investigation using another visual perceptual measure.
8. A study to ascertain if individuals from differing geographic regions and/or environments (rural vs. urban) differ in traffic related visual perceptual capabilities.
9. A study to ascertain the multiple correlation between the "Inventory," the "Perception Test," and the accrued driving records of the individuals in this study to determine the predictive value of combined use of the instruments.

10. A study to investigate the change in magnitude of the adjustment scale scores and the point which has indicated the shift from reasonably well adjusted individuals to individuals characterized by problems in adjustment. This shift has been demonstrated in other administrations of the "Inventory" and would seem to be of significant importance for driving.
11. A study to investigate driver behavior using individuals identified as good drivers and poor drivers in a behind-the-wheel situation. Stress would be introduced by means of conversation and the number of visual perceptual errors measured as indicated by mistakes in the manipulation of the vehicle (poor lane position, improper spacing, etc.).

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APPENDICES

APPENDIX A

RESPONSE SHEET FOR THE PERCEPTION OF TRAFFIC HAZARDS TEST

TRAFFIC AND SAFETY EDUCATION
Illinois State University

MCPHERSON PERCEPTION TEST

I. Example Slide: A. X , B. X , C. X , D. X , E. X , F. X , G. ___ H. _

II. Sample Question: A. ___, B. ___, C. ___, D. ___, E. ___

****

III. Begin Test

1. A. ___, B. ___, C. ___
2. A. ___, B. ___, C. ___, D. ___, E. ___
3. A. ___, B. ___, C. ___
4. A. ___, B. ___, C. ___, D. ___
5. A. ___, B. ___, C. ___, D. ___
6. A. ___, B. ___, C. ___, D. ___
7. A. ___, B. ___
8. A. ___, B. ___, C. ___, D. ___
9. A. ___, B. ___, D. ___
10. A. ___, B. ___, C. ___
11. A. ___, B. ___, C. ___, D. ___
12. A. ___, B. ___, C. ___
13. A. ___, B. ___, C. ___, D. ___
14. A. ___, B. ___, C. ___, D. ___, E. ___
15. A. ___, B. ___, C. ___, D. ___

For Scoring only

	1	2	3	-2	-3
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

APPENDIX B

THE MANN INVENTORY AND RESPONSE SHEET

MANN INVENTORY

Name_____ Age_____Sex____ ____
mo. da. yr. M F

	A	B	C	D	E
1.	( )	( )	( )	( )	( )
2.	( )	( )	( )	( )	( )
3.	( )	( )	( )	( )	( )
4.	( )	( )	( )	( )	( )
5.	( )	( )	( )	( )	( )
6.	( )	( )	( )	( )	( )
7.	( )	( )	( )	( )	( )
8.	( )	( )	( )	( )	( )
9.	( )	( )	( )	( )	( )
10.	( )	( )	( )	( )	( )
11.	( )	( )	( )	( )	( )
12.	( )	( )	( )	( )	( )
13.	( )	( )	( )	( )	( )
14.	( )	( )	( )	( )	( )
15.	( )	( )	( )	( )	( )
16.	( )	( )	( )	( )	( )
17.	( )	( )	( )	( )	( )
18.	( )	( )	( )	( )	( )
19.	( )	( )	( )	( )	( )
20.	( )	( )	( )	( )	( )
21.	( )	( )	( )	( )	( )
22.	( )	( )	( )	( )	( )
23.	( )	( )	( )	( )	( )
24.	( )	( )	( )	( )	( )
25.	( )	( )	( )	( )	( )
26.	( )	( )	( )	( )	( )
27.	( )	( )	( )	( )	( )
28.	( )	( )	( )	( )	( )
29.	( )	( )	( )	( )	( )
30.	( )	( )	( )	( )	( )
31.	( )	( )	( )	( )	( )
32.	( )	( )	( )	( )	( )
33.	( )	( )	( )	( )	( )
34.	( )	( )	( )	( )	( )
35.	( )	( )	( )	( )	( )
36.	( )	( )	( )	( )	( )
37.	( )	( )	( )	( )	( )
38.	( )	( )	( )	( )	( )
39.	( )	( )	( )	( )	( )
40.	( )	( )	( )	( )	( )
41.	( )	( )	( )	( )	( )
42.	( )	( )	( )	( )	( )
43.	( )	( )	( )	( )	( )
44.	( )	( )	( )	( )	( )
45.	( )	( )	( )	( )	( )
46.	( )	( )	( )	( )	( )
47.	( )	( )	( )	( )	( )
48.	( )	( )	( )	( )	( )
49.	( )	( )	( )	( )	( )
50.	( )	( )	( )	( )	( )
51.	( )	( )	( )	( )	( )
52.	( )	( )	( )	( )	( )
53.	( )	( )	( )	( )	( )
54.	( )	( )	( )	( )	( )
55.	( )	( )	( )	( )	( )
56.	( )	( )	( )	( )	( )
57.	( )	( )	( )	( )	( )
58.	( )	( )	( )	( )	( )
59.	( )	( )	( )	( )	( )
60.	( )	( )	( )	( )	( )
61.	( )	( )	( )	( )	( )
62.	( )	( )	( )	( )	( )
63.	( )	( )	( )	( )	( )

MANN INVENTORY

Response to the following statements appear to reflect an individual's feelings about himself and his relationships with other people. There are no right or wrong answers. Fill in on the answer sheet the response (A) always, (B) usually, (C) sometimes, (D) rarely, (E) never - that best reflects your feelings toward each statement.

1. I (like) (liked) to take part in organized extra-curricular activities in school.
2. Young people are much better drivers than are middle-aged people.
3. Policemen are sincere in enforcing traffic laws.
4. My parents (are) (were) reasonable in their relations with me.
5. My community is a happy place to live.
6. I put off until tomorrow things that I should do today.
7. I like to daydream.
8. I feel full of pep when I get behind the wheel.
9. I (live) (lived) in a home that (is) (was) happy.
10. If I see a police officer, I am more careful.
11. Over-careful drivers cause more accidents than the so-called reckless ones.
12. I enjoy being out late at night and sleeping mornings.
13. I get a feeling of real power when driving a car.
14. Courses in school (any grade level) are set up to meet the needs and interests of the student.
15. I am concerned about the way my clothes look.
16. Slow drivers should be kept off the highways.
17. New drivers should be required to take a course in driver education.
18. Unsafe drivers should be deprived of the right to drive.
19. Accidents (mishaps) don't just happen; they are caused.
20. I like to get everything out of a car that it has in it.
21. The chief work of most policemen should be traffic control.

(please turn to page 2)

22. My parents (exert) (exerted) too much control over me.

23. The people in my community want all traffic laws enforced.

24. I have been tempted to cheat on a test.

25. I get impatient in heavy traffic.

26. There are times when it seems like everyone is against me.

27. Old, defective cars should be kept off the road.

28. Drivers should be given more freedom in obeying traffic signs.

29. People should drive when they are angry.

30. Passing on hills and curves is exceedingly dangerous.

31. It is necessary to stop at "stop" signs if no other cars are in sight.

32. I like to put extras on my car to attract attention.

33. I am good at talking myself out of trouble.

34. Strong discipline in practice makes a better team.

35. I (am) (was) popular with most of the students in my class.

36. Police officers are rougher on teen-agers than on adults.

37. Teachers want to help students with their problems.

38. My (father) (principal driver in family) gets traffic tickets for moving violations.

39. I have as good table manners at home as when I eat out.

40. I have been wrong in an argument but wouldn't admit it to my opponent.

41. Society should have the right to question the way I drive.

42. I like to razz a team when it is losing.

(please turn to page 3)

43. I am proud of my reputation in the community.

44. I am considered a friendly person.

45. I like most of my work.

46. Our family (spends)(spent) a great deal of time together.

47. Attitudes toward driving are more important than ability to handle a car.

48. I like to take chances when I'm driving.

49. Traffic laws are set up to promote safety.

50. Courtesy toward other drivers is important.

51. I like a great deal of freedom.

52. I don't mind being told what to do.

53. My grades in school (are) (were) a good indication of my ability.

54. I (become) (am) concerned about what other people think of me.

55. I find that older people tend to be too bossy.

56. I feel somewhat nervous when I drive a car.

57. I think courtesy toward others is a good reflection of a person's character.

58. I get more fun out of driving a car than in any other activity.

59. The police are only trying to do the job for which they were hired.

60. My folks (insist) (insisted) that I spend most week-day evenings at home.

61. I am considered a reliable person.

62. I like to help a person who is in trouble.

63. I am more courteous than the average driver.

(FINISH)