ABSTRACT

A SYSTEMATIC ANALYSIS OF
TRAFFIC EDUCATION FOR
BEGINNING MOTORISTS

By

Kenard McPherson

<u>Statement of the Problem</u>

The major purposes of this study were (1) to develop curricular models depicting a conceptual scheme of traffic education which could be used by teachers in selecting content and providing instruction for future automobile operators and (2) to develop from the curricular models a course of study to guide teachers of beginning motorists. Included in the development of the curricular models were: (1) the objective of the highway transportation system and traffic education; (2) the major sub-tasks of the automobile operator; (3) the general abilities required of an automobile operator in driving situations; (4) the interaction of psychological factors and general abilities required of an automobile operator; (5) the major support systems which influence the operator's behavior; and (6) the major units to be taught in traffic education. The course of study included (1) guiding enabling, and performance objectives necessary for an automobile operator

to function effectively as a participant in the highway transportation system and (2) a classroom and laboratory traffic education content spiral to assist traffic education teachers in selecting and sequencing instruction.

Methods of Procedure

The curricular models depicting the conceptual scheme of traffic education were based on a search of pertinent literature. Following the construction and description of the curricular models, a suggested course of study was determined by the author.

Three expert judges, who reflected a broad concept of highway traffic safety, critiqued and reviewed the curricular models. Specifically the judges were asked to evaluate: (1) the material in terms of what a beginning motorist should know or be able to perform; (2) the appropriateness of this approach for traffic education curriculum development; and (3) the project in terms of needed improvements. The judges' observations regarding the models were reported. Further the judges' comments, which related to the course of study, were identified.

The Major Findings

The following is a summary of the major findings of this study. The findings are reported in terms of positive and negative acceptance of the units in traffic education by one or more judges. The units in traffic education were derived from the curricular models.

Kenard McPherson

1. Positive Responses About Units
   a. Overview: The Highway Transportation System
   b. Division I, Performance Tasks, Unit A, Basic Control
   c. Division I, Performance Tasks, Unit B, Routine Operations
   d. Division I, Performance Tasks, Unit C, Problem Solving Operations
   e. Division I, Performance Tasks, Unit D, Critical Control Operations
   f. Division II, Man-Machine-Environment Readiness Task, Unit A, Psychological and Physical Appraisals
   g. Division II, Man-Machine-Environment Readiness Task, Unit B, Vehicle Maintenance and Inspection
   h. Division II, Man-Machine-Environment Readiness Task, Unit C, Environmental Features and Trip Planning
   i. Division III, Controlling System and Task Failure, Unit A, Design and Packaging
   j. Division III, Controlling System and Task Failure, Unit B, System Failures
   k. Division III, Controlling System and Task Failure, Unit C, Accident Procedures

l. Division III, Controlling System and Task Failure, Unit D, Financial Responsibilities

m. Division IV, Self and System Improvement Task, Unit A, Strategic Driving

n. Division IV, Self and System Improvement Task, Unit B, Highway Transportation System Support and Improvement.

2. Negative Responses About Units

   a. Overview: The Highway Transportation System

   b. Division I, Performance Tasks, Unit C, Problem Solving Operations

   c. Division II, Man-Machine-Environment Readiness Task, Unit A, Psychological and Physical Appraisals

   d. Division IV, Self and System Improvement Task, Unit A, Strategic Driving

   e. Division IV, Self and System Improvement Task, Unit B, Highway Transportation Systems Support and Improvement.

In summary, each unit derived from the curricular models received positive comments from at least one judge and five units received comments which suggested that a potential driver did not need to know the information or that the content within the units required a change of emphasis for total acceptance.

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TABLE OF CONTENTS

LIST OF FIGURES

CHAPTER I

THE PROBLEM

The dependence of learning on environmental contingencies both of a psychological and physical nature places an enormous responsibility on educators. The situations in which a learner is placed, deliberately or otherwise, have determining and enduring effects on his behavior. The value of a deliberate education is based on the premise that learning situations and experiences can systematically be planned and controlled to benefit the learner.[1]

If conditions for learning are not based on a conceptual scheme an individual learner will at best have "experiences." When a conceptual scheme is absent neither the process nor the product of education can be accurately defined, and traditionalists, institutions, and persons of good opinion will control the curriculum.

Traffic safety education, although in infancy, is dominated by traditionalists, institutions, and persons of good opinion who may or may not have a conceptual scheme for determining the process or product in traffic education.

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[1]Robert M. Gagne, Conditions of Learning (New York: Holt, Rinehart and Winston, 1965), p. 4.

The nature of the traffic safety education discipline is influenced by a variety of organizations and institutions with various points of view. Currently, the effectiveness of driver education is being questioned and suggestions for improving driver education are being offered. The Secretary's Advisory Committee on Traffic Safety reported:

> The Highway Safety Act of 1966 requires that states shall provide comprehensive highway safety programs, including driver education. Unfortunately, the present state of knowledge as to the effectiveness of driver education provides no certainty, and much doubt, that the return on this enormous prospective effort will be commensurate with the investment. A broad and systematic inquiry is needed into the general question of how driving behavior is acquired, and how drivers can be taught not only to operate automobiles, but also to understand the major problems of highway safety including its crash and postcrash aspects.[2]

The report also included the following:

> . . . there is very little clear evidence in support of one driver education technique over another. For example, no one today can prove that behind-the-wheel instruction per dollar of cost is a better investment than the unit cost per hour of classroom instruction. Even more disturbing is the fact that no one as yet has produced clear proof that driver education, at least as presently constituted, has a significant favorable effect upon driver attitudes, motivation, performance or other achievements.[3]

The previous comments presented a challenge for systematically defining driver education. The report also identified content (attitudes, motivation, performance)

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[2] _Report of the Secretary's Advisory Committee on Traffic Safety_, U. S. Dept. of Health, Education and Welfare, February 29, 1968, p. 57.

[3] _Ibid._, p. 61.

which was not systematically derived further indicating the need for employing a conceptual scheme to delineate the discipline of traffic education. In addition to the controversy over content in driver education, the amount of instructional time allotted to driver education also varies even with proposed standards being less than adequate.[4]

The contemporary driver educator can rely on several sources of information for developing his traffic education course of instruction. Any of the desired approaches (traffic law, professional literature, accident causative factors, driver performance, and task analysis) provide a conceptual framework reflecting the nature of the traffic education curriculum. However, the instructional approaches are not well defined and some have already experienced failure as evidenced by current criticism of driver education.

Traffic laws or rules of the road have provided a common approach for many teachers. The traffic law approach has been appealing because of the availability of instructional materials, the ease in correlating classroom and laboratory instruction, and allotted instructional time available to driver education.

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[4]Herbert J. Stack, History of Driver Education in the United States (Washington: National Commission on Safety Education, 1966), p. 32.

A second departure has involved the study of professional literature. This approach provided a wealth of information but typically lacked a well defined concept of driving and seldom provided the sequential conceptualization necessary for preparing an individual to function in the highway transportation system as a motor vehicle operator.

The study of accident causative factors has been employed as a conceptual framework for driver education instruction. This technique covered the spectrum from national statistics to the study of one-car case studies. The accident research in which the statistical information was based had a host of uncontrolled variables. The research was further contradictory and lacked principles which could be applied in other crash situations. When employing this approach the driver education course usually lacked a sequential design, objectives were unclear, and the task of teaching seldom seemed to be terminated when formal instruction was concluded.

Two additional approaches, which were similar, for defining traffic education met with some degree of success. The first has been characterized as the study of driver performance. This method of study ranged from simulated methods to the operation of instrumented vehicles in actual traffic situations. The efforts of Greenshields[5] and Platt[6] were representative of this approach to traffic education. Typically, research in driver performance, tested specific hypothesis which resulted in an unsystematic approach to the problem and provided little applicable information for educators, i.e. the role of reaction time in operating an automobile.[7]

The second approach involved an analysis of the driving task. The performance elements involved in automobile operation were described. The content for instruction evolved around the concept of what a person had to do in actual motor vehicle operation. This approach required a systematic analysis, but could be limited to the concept of driving processes.[8]

The conceptual approach employed in teaching traffic education determined the nature and quality of experiences for the learner. The identified approaches contributed to the solution of the traffic education instructional problem, but did not provide a solution for the problem

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[5]Bruce D. Greenshields, "Investigating Traffic Highway Events in Relation to Driver-Actions," Traffic Quarterly (October, 1961), pp. 664-676.

[6]Fletcher N. Platt, Operations Analysis of Traffic Safety (Dearborn, Michigan: Ford Motor Company, 1959).

[7]Paul Babarik, "Automobile Accidents and Driver Reaction Pattern" Journal of Applied Psychology, 52 (1968), pp. 49-54.

[8]William G. Anderson, In-Car Instruction Methods and Content (Massachusetts: Addison-Wesley Publishing Company, 1968).

either singly or collectively. The traffic law method relied on cognitive learning of factual information. The accident factors approach placed the driver educator in the precarious position of attempting to solve a societal problem of highway accidents for which a variety of other institutions and agencies were also responsible.

A systematic approach to traffic education based on a conceptual model of operator abilities and sub-tasks required to function in a highway transportation system is needed before an adequate traffic education curriculum can be developed. In addition, research questioning the effectiveness of driver education methodology, or techniques employed can only be of value after the burden of driver education instruction is defined.

Statement of the Problem

The purpose of this study was to develop models which could be employed in developing a traffic safety curriculum. The models should aid teachers in content selection and provide a guide for systematic instruction in order to assist beginning highway users in functioning in the highway transportation system. Included in this analysis was an identification of factors required of an individual to function in the highway transportation system from an educational perspective:

a. an identification of the highway transportation system and the objectives of traffic education instruction.

b. an identification of the major sub-tasks of the automobile operator.

c. the development of a model and a description of the general abilities logically required of an automobile operator in driving situations regardless of sub-tasks which confront the operator.

d. the development of a model and a description of the interaction of psychological factors and general abilities required of an automobile operator.

e. an identification of the major support systems which influence the operator's behavior on the roadway of which a beginning driver should have an understanding.

f. the development of a conceptual curricular model which depicts the major units for traffic education instruction.

Model Design and Data Collection

The curricular models were based on a review of the existing literature. Following completion of the curricular models for traffic education instruction, three expert judges who reflected a broad concept of highway traffic safety were asked by letter to review and critique the material. A second letter which explained the judges' task and requested their cooperation accompanied the curricular material.

The opinions of the expert judges concerning the curricular models for traffic education instruction were reported in Chapter IV as part of the findings.

Further from the analysis and resulting curricular models, objectives and suggested instructional content were determined and reported in Chapter IV.

a. Educational enabling and performance objectives necessary for a beginning automobile operator to function effectively as a participant in the highway transportation system were identified. The objectives were based on the derived curricular models. The purpose of the objectives was to provide guidelines for traffic educators, not to provide restrictive, limiting, and likely to be refused objectives.

b. Secondly, traffic education instructional guidelines for teachers to use in selecting and sequencing learning experiences to help prepare beginning drivers to participate in the highway transportation system were developed. This curriculum evolved from the models and the enabling and performance objectives. Both a classroom and laboratory content spiral was determined, and the interaction between laboratory and classroom instruction was identified.

Importance of the Study

With the initiation of the National Highway Safety Bureau, interest in highway safety has intensified. The Highway Safety Bureau promulgated a number of standards covering various areas in traffic safety including driver education. As a part of the federal interest in highway safety, research supporting the effectiveness of driver education has been questioned.[9, 10, 11]

Moynihan, Chairman of the Secretary's Advisory Committee on Traffic Safety

> . . . believes that there is inadequate scientific information on the nature of the driving process and the factors affecting it and on the ways in which information obtained from research in this area can be employed in making driver education as effective as possible for different kinds of individuals.[12]

As a result of current criticism professionals involved in traffic education are attempting to support their positions. The National Commission on Safety Education asserted that it recognized and provided suggestions for improving driver education in 1964 as

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[9]J. William Asher, Do Driver Training Courses Produce Better Drivers? An Alternative Hypothesis (Purdue University), undated.

[10]Frederick L. McGuire, "Personal Factors in Highway Accidents: A Study in Prediction and Methodology: A Progress Report on the Mississippi Project," a speech for delivery to the National Safety Congress, October 23, 1967.

[11]*Report of the Secretary's Advisory Committee on Traffic Safety*, *op. cit*.

[12]*Ibid*., p. 58.

as evidenced by its publication Policies and Practices for Driver and Traffic Safety Education.[13] In addition to comments on increased sophistication and utilization of research in traffic and safety education, the Commission indicated its position on the nature of proposed research in the following statement:

> Practical advances in driver and traffic safety education may be achieved through investing energy, talent, and money in research to improve the existing program of instruction and, concurrently, in research directed to acquiring a better knowledge and understanding of those culturally operative human factors which create accidents. If driver and traffic safety education is to succeed in changing behavior, it must be based on a better understanding of how behavior is developed and how behavior may be changed.[14]

Cushman and Wahl have also attempted to define driver education. Their definition was as follows:

> . . . a valid curriculum offering that helps to prepare citizens to do better that which they'll be doing countless times for the rest of their lives - living in traffic.[15]

In a statement by the National Education Association (NEA), the emphasis was focused on: ". . . curriculum

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[13] A Commentary on Recent Reports Relating to Driver Education Research (National Commission on Safety Education). Statement developed by the Commission in June 1968 and subsequently endorsed by the American Driver and Traffic Safety Education Association, NEA, at its Annual Meeting at Pocatello, Idaho, August, 1968.

[14] Policies and Practices for Driver and Traffic Safety Education (Washington:, National Commission on Safety Education, 1964), pp. 52-53.

[15] W. Cushman and Ray Wahl, "Driver Education - What it is - and What It Isn't," Traffic Safety (August, 1968), p. 19.

content and teaching methods."[16] This focus included ". . . the human factor or . . . behavioral characteristics known to be related to traffic safety."[17]

Driver educators are mirroring the NEA's position. Bloomfield made an appeal to look at the total driver education program not merely phases. He suggested the use of innovative methods which provided for the student's examination of personal perceptions, values, interests, and attitudes in the learning-teaching process.[18]

Quane, in an article, questioned why driver education has not progressed as other disciplines, and why the laboratory program had developed at a greater pace than classroom instruction.

> With many disciplines taking a fresh look at what they were attempting to do, the curricula changed rapidly. Driver education managed to remain relatively unscathed. It clung to its traditional "do's" and "don'ts" and plodded along methodically. Recently, there has been a great upsurge in the laboratory phase of driver education. Simulators, multiple car off-street driving ranges, and creative in-car teaching techniques among other innovative practices have greatly enriched instruction. The classroom portion of driver education, however, hasn't kept pace.
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> Why has classroom instruction lagged so badly in so many places? One part of the answer relates to the central theme of the classroom

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[16] ______. "The NEA Has Its Say," Traffic Safety (December, 1968), p. 14.

[17] Ibid., p. 14.

[18] Gary J. Bloomfield, "Remember the Classroom," Safety (January-February, 1969), p. 15.

> curriculum. There frequently is no focal point. Teachers and students jump from topic to topic with no specific purpose or guiding principle. Too often the objective of classroom instruction has been to pass the written part of the license examination.[19]

He further indicated that driver education could be structured by employing the concepts of human factors engineering and system analysis to driver education curriculum development.[20]

As indicated by the previous articles there is concern about the effectiveness and future direction of driver education. Hopefully this study will make a contribution by providing both a conceptual structure and a direction of development for driver education.

Scope of the Study

This study was a theoretical formulation of a driver education curriculum. It was developed from an educational perspective to provide guidelines for driver educators. It was not designed to include all aspects of highway safety nor were mathematical models developed to define the driving task. The product was based on pertinent existing literature and advisement from expert judges. The final product is not a detailed analysis of every item, task or sub-task which could be included in driver education, but consists of objectives and a course of study for

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[19] W. Laurance Quane, "New Approach to Classroom Instructions," *Safety* (May-June, 1969), p. 26.

[20] *Ibid.*, p. 27.

traffic education based on a theory of a driving process and the relation of highway users to the highway traffic system.

Definition of Terms

Traffic Education: For purposes of this study, traffic education encompassed the former concept of driver education, but was not limited to basic skill development. In this study the purpose of traffic education was to develop those cognitive, affective, and performance skills necessary to function as a highway user in the highway transportation system.

System Analysis: "The definition of system is in a sense arbitrary and depends heavily on a prior definition of a task or problem."[21] The concept of system was employed to describe, predict, and control individual behavior. A system could be vague and general in nature such as the social system or it could be a specific man-machine system. The interaction between an operator and an automobile composed a system.[22] In this study, system analysis was employed as a method for describing, structuring, and theorizing about the traffic education content and concepts for beginning motor vehicle operators.

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[21]Robert M. Gagne, *Psychological Principles in System Development* (New York: Holt, Rinehart and Winston, 1966), p. 15.

[22]*Ibid.*

Performance Objectives: For purposes of this study, performance objectives referred to desired behavior as a result of instruction at the termination of formal instruction.

Enabling Objectives: For purposes of this study enabling objectives ". . . state in precise terms the specific knowledge/skills the student must learn in order to arrive at the terminal performance."[23]

Course of Study: For purposes of this study course of study referred to a topical outline of content for beginning highway users in traffic education. The course of study included both classroom and laboratory content sequences.

Expert Judges: For purposes of this study expert judges referred to those persons with expertise who were selected to review and critique the curricular models.

Organization of the Remaining Chapters

Chapter II contains a review of literature. The literature was drawn from both driver performance and system analysis human factors engineering literature concerning driving or driver education. Presented in Chapter III are the models reflecting the general abilities required of an operator of an automobile; the relation of the general abilities and psychological factors which

[23] Instructional Simulation Newsletter 2,1, Teaching Research, Oregon State System of Higher Education, Monmouth, Oregon (February, 1969), p. 4.

influence an operator; and major support systems of the highway transportation system in which a beginning driver should have a cognitive understanding. Chapter IV contains the findings based on the judges' responses to the models, objectives, and the traffic education course of study. Presented in Chapter V are the summary, conclusions, and the recommendations.

CHAPTER II

REVIEW OF LITERATURE

The review of literature revealed several areas which related to man's successful operation of a motor vehicle. The areas were classified into driver characteristics, attitudinal and personality considerations, human functions, and task analysis requirements.

Driver Characteristics

The focus of driver characteristics covered primarily visual aspects and reaction time of the motor vehicle operator. However, some literature was devoted to the less easily measured human functions involved in driving such as perceptual style, judgmental ability, and decision-making ability.[24, 25]

Visual Characteristics

The derived relationship between various measures of driver characteristics and accident frequency has been low.

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[24]Babarik, op. cit.

[25]Gerald V. Barrett and Carl L. Thornton, "Relationship Between Perceptual Style and Driver Reaction to an Emergency Situation," *Journal of Applied Psychology*, 52 (1968), pp. 169-176.

Goldstein,[26] in a comprehensive review of literature on human characteristics thought to be important in safe motor-vehicle operations, discovered low relationship between various identified predictors and accident behavior. Goldstein found in over 45 studies that the correlation between criteria measures and visual functioning (acuity, depth, balance, etc.) were never higher than .20. He further revealed a correspondingly low correlation with accident criteria and the use of psychomotor tests, sensory perceptual tests, and cognitive measures.[27]

Both Goldstein[28] and Lauer[29] recognized that motor-vehicle operation was a perceptual-motor skill, but could establish few strong positive relations between perceptual-motor variables and accident criteria. Goldstein argued that accident records fail to measure stable driver characteristics, since accident status in one period of time is only slightly related to accident status in another

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[26]Leon C. Goldstein, _Research on Human Variables in Safe Motor Vehicle Operation: A Correlation of Summary of Predictor Variables and Criterion Measures_. The Driver Behavior Research Project, George Washington University, June, 1961.

[27]Leon C. Goldstein, "Human Variables in Traffic Accidents; A Digest of Research," _Highway Research Board Bibliography 31_, National Research Council, Washington, D. C., 1962.

[28]_Ibid_.

[29]A. R. Lauer, "A Comparison of Group Paper and Pencil Tests with Certain Psychophysical Tests for Measuring Driver Aptitudes for Army Personnel," _Journal of Applied Psychology_, 39 (1959), pp. 318-321.

period. Hence, accident records are only slightly predictable measures of more or less stable driver characteristics such as vision.

Barrett and Thornton[30] raised two additional considerations when studying driver characteristics. First, past investigators have employed heterogeneous measures of operator accident behavior. The researchers have made little effort to logically group or categorize accidents. Secondly, the identified predictors frequently failed to have any conceptual, theoretical, or logical relationship to the accident behavior which was to be predicted.

With the precautions identified by Goldstein, Barrett, and Thornton, a more detailed investigation of visual characteristics was possible.

Cobb[31] conducted a research study in which he correlated static visual acuity with the number of accidents per year. His sample population consisted of over 3,000 drivers in the State of Connecticut, some of whom had been involved in recent accidents, and the remainder of whom were volunteers. The control group was 92.7 percent male. Nine measures of static visual acuity were correlated with the number of accidents per year. The

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[30] Barrett and Thornton, op. cit.

[31] P. W. Cobb, "Automobile Driver Tests Administered to 3,663 Persons in Connecticut, 1936-37, and the Relation of the Test Scores to the Accident Sustained." Unpublished report to the Highway Research Board, Washington, D. C., July, 1939.

correlations ranged from a high of .065 to a low of .028, the former value having statistical significance.

Brody[32] compared 26 accident repeaters and 26 control cases on several measures of vision, including acuity. No significant difference in acuity performance was revealed. In a later report, Brody[33] compared 375 chronic violators, 133 accident repeaters, and 124 controls on a number of psychomotor and psychological tests. The groups did not differ in static visual acuity.

Cobb[34] further found in his study on field of vision, no relationship between four different measures of visual field and accidents per year.

Brody,[35] in comparing 26 accident repeaters with 26 controls, found a slight but significant difference in "side vision" in favor of the control group.

Low[36] studied peripheral motion acuity, using a specially modified perimeter to display Landolt (C) rings in the horizontal meridian. Using 50 subjects, Low exposed

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[32]Leon Brody, Personal Factors in Safe Operation of Motor Vehicles, New York University Center for Safety Education, 1941.

[33]Leon Brody, "Personal Characteristics of Chronic Violators and Accident Repeaters," Highway Research Board Bulletin, 152, 1957.

[34]Cobb, op. cit.

[35]Brody, Personal Factors . . ., op. cit.

[36]F. N. Low, "The Peripheral Motion Acuity of 50 Subjects," American Journal of Physiology, 148 (1947) pp. 124-133.

the target (moving at 15 degrees per second) for 15 degrees of arc at various positions on the perimeter. He found that motion acuity fell off rapidly as the target path moved toward the periphery. He also found that form discrimination deteriorated when an object was moving and that there appeared to be little practice effect in dynamic visual acuity performance. The study showed peripheral motion acuity to be poorer than foveal motion acuity which was in accordance with other findings indicating that retinal resolution was at its highest level in the fovea.

An extensive research program was initiated at the United States Naval School of Aviation Medicine at Pensacola, Florida by Ludvigh and Miller. A series of publications, beginning in 1953 and ending in 1962, presented detailed results from this program.[37]

Using a population of naval aviation cadets that ultimately numbered 1,000 and Landolt rings presented monocularly by means of a front surface rotating mirror, Ludvigh and Miller studied various aspects of motion acuity. The results of this research as summarized by Burg follows in part:

1. Acuity vs. Velocity - As the velocity of the test object increased from 10 degrees per second to 170 degrees per second, visual acuity deteriorated markedly.

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[37]Albert Burg, An Investigation of Some Relationship Between Dynamic Visual Acuity; Static Visual Acuity and Driving Record, Report #64-18, Department of English, University of California, April, 1964, p. 30.

2. Dynamic vs. Static Acuity - Individuals with the same static acuity could differ markedly and significantly in their dynamic acuity. No significant correlation was found between static and dynamic acuity performance. It was discovered that if one individual was superior to another at a low angular velocity it was not necessarily true that this superiority persisted for a high angular velocity.[38]

Burg in his investigation of relationships between dynamic visual acuity, static visual acuity, and driving record obtained evidence that suggests a positive relationship between good visual acuity (primarily dynamic visual acuity) and good driving record (specifically, lack of citations). Burg summarized the relationship between DVA and SVA in the following statement:

> It is possible that static acuity is but one determinant of DVA, while there maybe other factors underlying DVA performance, such as neck muscle coordination, perceptual reaction time and the like, that are also important to successful performance of the visual task in driving.[39]

Bartlett, *et al.*[40] conducted a study on symbol recognition time in peripheral vision. They reported:

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[38] *Ibid.*, pp. 31-34.

[39] *Ibid.*, p. 94.

[40] Neil Bartlett, *et al.*, "Recognition Time for Symbols in Peripheral Vision," *Highway Research Board Bulletin 330*, January, 1962, pp. 87-91.

> Of all the sensory capabilities exhibited by the driver, the sense of vision is almost wholly responsible for the processing of information in the driving situation. However, little is actually known about the time that this 'processing' requires. It was for this purpose of obtaining information on the visual reaction and eye movements, that this research was designed.[41]

The first part of the research consisted of developing a transportable recording system to record drivers' eye movements in a moving vehicle. The second phase consisted of the actual investigation of driver response time to signals in the peripheral. Four basic premises were tested and confirmed:

1. Response time was greater than simple movement responses. This premise was based on the latency concept. Latency was defined as the time interval between the appearance of a target in the peripheral and initial eye movement.

2. Response time increased as a function of angular displacement from the foveal area.

3. Response time was increased as the number of targets were increased.

4. Time required for each of the three components of the response increased as the angle away from direct vision increased.

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[41] Ibid., p. 87.

Ittleson[42] stated that there were three conditions in which size served as a cue to distance: "(1) Relative size as a cue to relative distance; (2) Absolute size as a cue to absolute distance; and, (3) Change of size as a cue to change in distance."[43]

That relative size served as a cue to relative distance was a generally accepted conclusion. That the absolute size of an object served as a cue to its absolute localization in space, however, was not, generally accepted. Ittleson measured the distance response for several observers viewing a variety of test objects (playing cards of various sizes, a matchbox, typewritten business letter, and cut-out geometrical shapes) in an apparatus which consisted of an experimental field and a comparison field shown alternately in the same direction. The subject was given a monocular view of the test objects placed in the experimental field. The distance was fixed and all cues for distance except the size of the object were either eliminated or controlled. A binocular view of the comparison object (a cigarette pack or a checker board) was afforded in order to provide reliable distance indications in the comparison field. The subject's task was to move the comparison object so that it appeared to be the same

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[42] W. H. Ittleson, "Size As A Cue To Distance: Static Localization," American Journal of Psychology, LXIV (January, 1951), pp. 54-67.

[43] *Ibid.*, p. 54.

distance from him as the test object. The results, according to Ittleson, demonstrated the dependence of the subject's measurements on retinal size and assumed size under these conditions. Ittleson stated that absolute size operated as a cue to absolute distance in the following manner:

> A perceptual integration is reached between the physiological stimulus-size related to that particular characterized stimulus-pattern. The object is localized by O at the point at which an object of physical size equal to the assumed-size would have to be placed in order to produce the given retinal size.[44]

In the 1950's, a visual training program for professional drivers was developed by Smith, Cummings, and Sherman. The seeing system had appeal, the principles were logical, and the training objectives were clearly stated. The main purpose of the training was for: "(1) developing systematic search habits to detect potential driving hazards and (2) using driving strategies to dispose of potential hazards before they became critical."[45]

Payne and Barmack,[46] in a study entitled "An Experimental Field Test of the Smith-Cummings-Sherman Driver Training System" attempted to test the actual

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[44] Ibid., p. 66.

[45] Donald Payne and Joseph E. Barmack, "An Experimental Field Test of The Smith-Cummings-Sherman Driver Training System," Traffic Safety Research Review, 7 (March, 1963), p. 10.

[46] Ibid.

benefits of the training system. In the preliminary investigation questionnaires were sent to 49 fleets who had provided the training program for their employees. On the basis of 35 returned questionnaires the results indicated that there were slight improvements in accident rates for most companies. As a result of these findings, an experimental evaluation of the training program's effectiveness was justified.

> The general plan for the field test was as follows:
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> 1. The drivers were to be divided into two groups, matched for seniority and accident history.
> 2. One of the groups was to be trained, using the Smith-Cummings-Sherman training system.
> 3. Following the training there was to be a 15-month waiting period. Individual records of the mileage and accidents were to be collected for each driver during this period. To minimize outside influences, no major changes were to be made in the fleet's safety program or accident recording procedures.
> 4. At the end of the waiting period the records of the two groups of drivers were to be compared. If the training program was effective, the trained drivers would have better accident records than the untrained drivers.[47]

Accidents were classified into avoidable and unavoidable accident categories. Four judges, including Smith, determined if the accident was avoidable or unavoidable. When considering all accidents of the two groups, with a mileage criteria, no significant difference existed.

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[47] *Ibid.*, p. 11.

". . . the difference in accident rates between the trained and untrained drivers could be explained simply by random fluctuation."[48] A comparison of trained and untrained for all accidents was made on a cost basis and no significant difference was found. However, ". . . comparisons involving avoidable accidents . . . favored the trained drivers . . . the trained groups did <u>worse</u> than the untrained group on all comparisons involving unavoidable accidents."[49] It might be concluded that the training program lessened driver's vulnerability to avoidable accidents and increased his vulnerability to unavoidable accidents.

Payne and Barmack concluded:

> 1. Effectiveness of the Smith-Cummings-Sherman training system - as a system - in preventing certain types of accidents by experienced professional drivers, was not demonstrated unequivocally. Neither accident rates nor accident costs differed significantly between the trained and untrained drivers.
>
> 2. It is possible that the merits of the system might be demonstrated more easily and might produce more convincing results with beginners rather than with professional drivers.
>
> 3. Effectiveness cannot be evaluated independently of the trainers. It is possible that the Smith-Cummings-Sherman system may produce useful results with some trainers. If some trainers are more effective than others, it is important to identify who will be an effective trainer.
>
> 4. One important practical question is still unanswered. Should the Smith-Cummings-Sherman training system be recommended for fleet use?

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[48] *Ibid.*, p. 12.

[49] *Ibid.*, p. 12.

> A blanket answer is not possible. The field test results indicate that the fleet safety director who uses the training system may or may not get significant accident reductions, depending upon who does the training. Because of this uncertainty, the final decision must be an individual one.[50]

<u>Driver Response Characteristics</u>

Driver response characteristics research generally tested hypotheses to determine the relationship between driver performance, accident involvement, and specific driver characteristics.

Babarik[51] conducted a study to investigate the operator's perceptual motor function in relation to automobile accidents. One hundred and twenty-seven taxicab drivers, were employed as the sample population. The subjects had at least two years experience as taxicab drivers.

> The primary aim of this study was to determine the relationship between one pattern of perceptual-motor behavior and one type of accident. The perceptual-motor behavior considered was the ratio of simple reaction time to jump reaction time and the kind of accident was the rear-end collision or struck-from-behind.[52]

The struck-from-behind accident was chosen as the criterion variable because of the common-sense link with reaction pattern and the frequency of this type of collision.

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[50] *Ibid.*, pp. 13-14.

[51] Babarik, *op. cit*.

[52] *Ibid.*, p. 49.

In this study, response time was fractionized into initiation and movement time. Initiation time was the time required to begin the movement in response to the target. Jump reaction time was made up of initiation and movement time.

> . . . it was hypothesized that drivers whose initiation time is abnormally long portion of their total perception reaction (drivers who have a high ration of RT JRT) would have a higher percentage of accidents in which they were struck from behind than would drivers whose perceptual-motor RT shows a typical ration . . . the corollary hypothesis that they would collide with vehicles in their headway <u>less</u> frequently was also tested.[53]

The findings indicated that drivers with atypical reaction patterns were more likely to be struck-from-behind. This desynchronizing reaction pattern was heavily represented in the multiple struck-from-behind category. The corollary hypothesis that drivers with the desynchronizing reaction pattern have fewer headway accidents was supported. The discussion of results was in terms of selection, testing, training, legality, and human engineering.

Barrett and Thornton[54] studied perceptual style and driver reaction to emergency situations. Perceptual style was measured with the standard Rod and Frame Test (Witkin). The original sample consisted of 50 males, randomly selected from a population of 1200, between 30

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[53] <u>Ibid</u>., p. 50.

[54] Barrett and Thornton, <u>op. cit</u>.

and 45 years of age. The data was gathered on a sample of twenty because of simulator sickness and lessor reasons.

Barrett and Thornton ". . . attempted to find a predictor which would have a logical relationship to the emergency response."[55] In this study:

> An analysis of the situation indicated that the main tasks were to detect and identify the pedestrian. This appeared to be related to Witkin's concept of perceptual style . . . sudden pedestrian emergence into the field of view presented a figure in an embedded context. Since the behavior required of the subject in the simulated driving situation appeared to be related to perceptual style . . . it was hypothesized that the field-independent individual should be more effective in reacting to the emergency situation than would field-dependent individuals.[56]

The results of the perception test (RFT) were compared with the subjects response of: a) initial brake reaction, b) deceleration rate, and c) hit-miss dichotomy. "The results confirmed the hypothesis that perceptual style was significantly related to the ability to react to emergency situations."[57] Discomfort was not a significant factor in initial reaction time but was a factor in deceleration rate.

Moseley,[58] in his article "Let's Train Drivers for That Last Crucial Moment," seemed to be supporting the

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[55] Ibid., p. 170.

[56] Ibid., p. 170.

[57] Ibid., p. 172.

[58] A. L. Moseley, "Let's Train Drivers for that Last Crucial Moment," Traffic Safety (September, 1961) pp. 8-10.

reaction or response concept of driver characteristics. He suggested that we train drivers to make responses to such hazards as soft tires, brake pedal loss, sudden power steering loss, returning from the shoulder, and skidding. Moseley stated:

> Emergencies happen fast. When sudden danger looms on the highway, the driver has no time to analyze the situation and take deliberate action. He must act quickly and - if he is to survive - he must act wisely.[59]

Personality and Attitudinal Characteristics

Personality and attitudinal characteristics were viewed as factors which contribute to successful or unsuccessful motor vehicle operation. For the most part research focused on the negative aspect of personality and attitudinal characteristics. Hence the majority of the research concerning personality and attitudinal characteristics was found in accident literature.

Accident Proneness

In early studies of accident behavior the psychological aspects were encompassed in the concept of accident proneness.[60, 61] However, the proneness concept was

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[59] Ibid., p. 9.

[60] W. Haddon, E. Suchman, and D. Klein, Accident Research (New York: Harper and Row, 1964).

[61] Major Greenwood and Hilda Woods, "The Incidence of Industrial Accidents with Special Reference to Multiple Accidents," Medical Research Committee, Industrial Fatigue Research Board, Report No. 4, 1919.

questioned and partially negated by the work of Adelstein[62] when he controlled the variables of time and population. Further, enlightenment concerning accident proneness was reported by Miller.[63] He demonstrated statistically that those persons appearing to be prone to accidents could be expected to have several mishaps on the basis of chance.

You Drive As You Live

Focusing on the psychological aspect of motor vehicle operation, a recent concept, "We Drive As We Live," attempted to explain man's behavior as an automobile operator. Those who expounded this concept recognized driving as a human activity much like other activities that reflected patterns of life. Turfboer[64] stated that:

> Driving a car is a form of human activity--an activity which can and does express one's personality and social attitudes. Thus, driving a car is a form of expressive human behavior. Human behavior in a given society is subject to self-imposed limits of activity. This range of behavior is considered socially acceptable. It varies according to social attitudes. Social attitudes, expressing these limits of acceptable behavior, are spelled out in our laws. They also change according to contemporary attitudes. At the same time laws

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[62] A. M. Adelstein, "Accident Proneness: A Criticism of the Concept Based Upon An Analysis of Shunters' Accidents," Journal of the Royal Statistical Society, Series A, CXV (1952), pp. 354-400.

[63] Gene Miller, "Accident Repeaters May Not Be Accident-Prone," National Safety News, LXVII (March, 1953), pp. 3-6.

[64] Robert Turfboer, "Do People Really Drive As They Live?" Traffic Quarterly, 21.1 (January 1, 1967), pp. 101-108.

> spell out the consequences of trespassing legal limits. It is sometimes overlooked that the latter statement is incomplete without the addition: <u>If one is apprehended</u>! There are people who will trespass these limits if there is little or no danger of getting caught.[65]

This concept was further emphasized by Edwards[66] when he stated:

> Every decision depends on a man's judgments about what's at stake; in analyzing the decision, we should start with a payoff matrix. But the entries in the payoff matrix should be subjective, not objective quantities . . .
>
> On the highway, however, I believe that the bets accepted by drivers are typically, subjectively, quite favorable. That is, the sum of the products of the utilities and subjective probabilities of the favorable possible outcomes substantially exceeds the sum of the products of the utilities and subjective probabilities of the unfavorable possible outcomes. The reason, I believe, is simply that people fail to assess the negative value of disaster to be as highly negative as it really is.[67]

It appeared that the motorist entered into driving much in the same perspective as he did other human activities. Otherwise, he "drives as he lives." According to Turfboer, the "average" person drives in an "average" manner. The alcoholic drives in an aggressive manner. However, some do not drive as they live and they could be the real challenge.

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[65] *Ibid.*, p. 101.

[66] Ward Edwards, "We Drive As We Live," *Analogy* (Spring, 1968), pp. 20-22.

[67] *Ibid.*, pp. 20-21.

> Driving, as stated before, is a form of expressive behavior. It often expresses the driver's emotional state of mind, his attitude toward the world and his fellow citizens. Driving, then, is like other expressive emotions, such as anger, passivity, confusion, fear, euphoria. Thus driving can become an outlet for a state of mind, a mood, an attitude. Driving, as they say of a picture, can speak better than a thousand words. Through driving his car a man can express something which he cannot say in words. Why is this so? Psychiatrists call this type of behavior 'acting out.' And what is being acted out is a conflict of which there is no awareness, or of which there is only partial recognition.
>
> In other words, it is possible that an individual is unaware of a deeply rooted emotional or mental conflict which begs for a solution. But because it is unconscious it cannot be resolved as ordinary or reasonable action. There remains only an emergency exit, through acting out.[68]

Identifiable Personalities

Lynnete Shaw[69] studied behavioral and social factors of those persons employed by the Public Utility Transportation Corporation in South Africa. The results of her ten year study demonstrated a relationship between subject's responses to items in the Thematic Apperception Test and Social Responsibility Test and the subject's driving record.

Operating from the perspective that persons with different driving records represented different risks as

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[68]Turfboer, op. cit., p. 103.

[69]Lynnete Shaw, "The Practical Use of Projective Personality Tests as Accident Predictors," Traffic Safety Research Review, 9, 2 (June, 1965), p. 34.

measured by accidents, Shaw classified rish into five descriptive categories:

> <u>The Potentially Bad Accident Risk</u> . . . The person who is emotionally unstable and extremistic . . . <u>The Potentially Poor Accident Risk</u> . . . The person who displays little energy, stamina or interest. . . . <u>The Potentially Borderline Accident Risk</u> . . . The weak person who could be easily influenced. . . . <u>The Potentially Fair Accident Risk</u> . . . The person who has his good points and his bad points, with the bias in favor of the good . . . <u>The Potentially Good Accident Risk</u> . . . The contented person who is in no way outstanding but who is friendly, cheerful, adaptable and accepting provided he is reasonably intelligent, realistic and mature.[70]

Miss Shaw recognized that: "It would . . . be virtually impossible to prepare a guide that would cover all contingencies, for . . . it is the <u>total personality pattern</u> that matters and particularly the balance and integration of that pattern."[71] However, her categories were descriptive and could be used as guides for observing behavior.

<u>Attitudes and Other Behavioral Characteristics</u>

Blumenthal[72] in an article, "Value Conflict, Decision Processes and Traffic Safety," identified the relationship of values with the kind of efficiency of

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[70] <u>Ibid</u>., pp. 64-65.

[71] <u>Ibid</u>., p. 65.

[72] Murray Blumenthal, "Value Conflict, Decision Processes and Traffic Safety," <u>Traffic Safety Research Review</u>, 10, 3 (September, 1966), p. 89.

the transportation systems selected. Although Blumenthal's intentions were not directed towards the study of values as they influence the individual motor vehicle operator, he revealed several examples of values that could influence safe motor vehicle operation in both a positive and negative manner.

> Some of the values associated with the use of the motor vehicle are near universal availability, mobility, speed, convenience, economic benefits, social and psychological gratifications such as the sensations of autonomy, status, power, pleasure, privacy . . .[73]

The latter, dealing with social and psychological gratifications, are of primary importance to psychologists and educators. Blumenthal further signified the importance of appriasing values in traffic education by making a distinction between positive values and non-rational values. "By non-rational values, I (Blumenthal) refer to the cultural elaboration of the motor vehicle that enables it to foster the illusions of autonomy, power, privacy . . ."[74]

Forbes[75] identified attitudes, emotions, and other responses of aggressive and passive behavior as personality factors. He believed that specific knowledge of these factors could assist in the education or learning process

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[73] *Ibid*., p. 89.

[74] *Ibid*., p. 89.

[75] T. W. Forbes, "Human Factors in Highway Safety," *Traffic Safety Research Review*, 4, 1 (March, 1960, pp. 8-11.

necessary to the development of personality. On a more basic level, Forbes believed that knowledge, motivation, and attitudes could influence the kind of reaction an operator made in the immediate situation. He stated:

> Knowledge about hazards in itself is of great importance in determining attitudes and motivations. The alertness the driver maintains may also depend, at least partly, on how strongly he is aware of its necessity and his knowledge about how to maintain it. We need more human factors research of the psychological and sociological type to find out how different groups of drivers, safety organizations and others, affect each other.[76]

Forbes further indicated that many drivers do not know what we think they know, including some driver education instructors.

The President's Committee on Traffic Safety in their conference on traffic behavior research,[77] identified in their report a section referred to as "Psychology of Driver Behavior." The report described driver behavior as a system. The driver behavior system was composed of three parts: input, organizations, and output. The report, which follows in part, made several statements and raised many questions which further signified the importance of the psychological aspects of motor vehicle operation.

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[76] Ibid., p. 8.

[77] ________, "President's Committee on Traffic Safety, Conference on Traffic Behavior Research," Behavioral Science, 3 (1958), pp. 347-355.

> . . . How may 'big brother' controls substitute even for the more automatic driver behaviors? It is of special importance that the entire area dealing with attention (underlining added) be investigated, with particular reference to different driving conditions, and in a wide sample of drivers. Motivational systems account in large measure for the functioning of the organization factor. What are these systems? How do they develop? What is the role of anxiety, and how does it relate to enforcement on the one hand and good driving on the other? What constitutes effective rewards and punishments in the development of driving skills? How may these be incorporated into an educational program which has as its end point training for effective and safe driving under all road conditions?[78]

The report raised these questions several years ago and unfortunately few solutions have been discovered in subsequent years.

Dr. Goldstein,[79] in a series of lecture-discussions on traffic problems in the United States, provided insight into the difficulty of finding solutions when dealing with the psychology of the driver when he stated:

> . . . knowledge of the facts . . . is often not enough to adjust people's attitudes. People must be informed, yes, but attitudes are the result of many things . . . Habits of living, habits of thinking, and habits of feeling are developed in a social setting, and it is difficult for an individual to change his attitudes or his behavior or his habits unless such change is in harmony with the attitudes and behavior of his social group.[80]

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[78] Ibid., pp. 350-351.

[79] Leon Goldstein, "Psychological Aspects of Traffic Accidents," Traffic Digest and Review (July, 1964), pp. 10-12.

[80] Ibid., p. 11.

Modifying Attitudes for Driving

The study of personality theories provided evidence on whether or not attitudes could likely be changed. According to theories attitudes could be encompassed by either the core tendencies of an individual or by the periphery of personality. However, only one major personality theory denied the possibility of attitudinal change beyond childhood; that being the pure psychosexual theory.

> Frued shows vividly his emphasis on the essentially unchanging nature of adult personality. Any changes taking place beyond puberty are not basic or radical. In contrast, the fulfillment positions see personality as a rather continually changing thing . . . the emphasis is also strong in some perfection theorists, like Allport, who sees life as a series of changes toward ever increasing individuality.[81]

Mann[82] identified three causes of accidents. The projection of personality was included as one of the causative factors. He divided the concept of projection of personality into two parts: (1) a more or less normal group and (2) people with some degree of mental illness or anxiety. From Mann's report, both groups appeared to be of major concern to safety-minded people. Almost every individual at one time or another could be in an unsafe emotional state. Mann, further asked the more basic

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[81]Salvatore R. Maddi, Personality Theories (Homewood, Illinois, Dorsey Press, 1968), p. 214.

[82]William Mann, Building Attitudes for Safety, presented at the National Safety Congress, 1960.

question: ". . . What can we do to improve the situation?"[83] The general solution to the question was to provide knowledge and develop safer driving attitudes through a new and different approach in driver education.[84] In driver education particular emphasis would be directed toward why we behave as we do.

Mann's article also included a definition of attitudes and factors which determine attitudes, but of most importance, the following suggestions were included for developing satisfactory attitudes.

> 1. The driver education teacher, as a person, must be a well adjusted individual with genuine liking and concern for his students.
>
> 2. The driver education teacher must be broadly educated in traffic safety. He should have informed opinion of everything from selective enforcement to the advantages of one-way streets.
>
> 3. The driver education teacher should be well versed in the dynamics of human behavior so that he can understand why individual students behave as they do and can help them to gain insights into their feelings and actions.
>
> 4. The curriculum should include a unit on attitudes and effects of personality that goes much deeper than that covered by our present textbooks.
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> 5. Attitudes and personal responsibility should be woven throughout the course as opportunity presents itself.
>
> 6. In the car, courtesy to other drivers and pedestrians should be stressed and errors of

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[83] _Ibid_., p. 6.

[84] William Mann, Let's Talk It Over," _Analogy_, Charter Issue (1966), pp. 4-9.

other drivers, which result from faulty attitudes, should be pointed out.

7. Class projects, such as a community survey of driving irritations, can bring the importance of attitudes to the students in an effective manner as well as giving them a feeling of realism in their studies.

8. Orientation of the entire school faculty to the breadth and depth of driver education so that unprofessional remarks of colleagues will not inhibit the growth of the student.

9. The class should make field trips to traffic courts, the traffic division of the police department, and the city traffic engineer so that the student can better understand the functions of these agencies.

10. Talks by traffic judges and police officers on policies and problems to help the student in his understanding of the errant driver and the difficulties enforcement agencies face.

11. Projects or discussions of the physiological and psychological effects of alcohol and drugs. We have tended in the past to omit or handle poorly the psychological effects, and have thus left doubts in the minds of our students.

12. Cooperate with the school counselors and other teachers in helping individuals who exhibit symptoms of maladjustment and anxiety.

13. Make clear to the students that personal behavior in accepting the responsibility that is necessary in driving is an integral part of the course. Fail students whose attitudes cause the teacher to feel that they will be unsafe drivers.

14. Inform the parents of the goals of driver education, its limitations, and any individual weaknesses of their youngsters.

15. Conduct an adult education program including violator schools, releases to newspapers, radio and TV programs, and talks to community organizations.

16. The driver education teacher must practice what he preaches and should encourage other teachers to follow acceptable driving behavior.[85]

According to Pepyne[86] attitudes regarding driving were developed by a complex interaction of social and personal factors. Pepyne reported that attitudes could actually affect the psychological aspects of driving which were identified by him as attention, perception, interpretation, decision, and action. He further stated that attitudes were acquired by adoption, integration, correlation, and traumatization. Once acquired, attitudes tended to be self-preservative in nature. In spite of the self-preservative nature of attitudes, Pepyne felt attitudes could be changed by a person who understood the role the attitude served for the individual. He stated:

> By combining his general knowledge of his students with information the specific attitudes of each, a driver educator can institute and effective program to change undesirable attitudes . . .[87]

Stewart[88] in an article published in Educational and Psychological Measurement, stated that we need more research in methods of changing attitudes of the individual operator

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[85] Mann, Building . . ., op. cit., pp. 10-12.

[86] Edward Pepyne, Changing Driver Attitudes, An address delivered to the Driver Education Section of the MEA Regional Conference at Ann Arbor, October 12, 1956.

[87] Ibid., p. 7.

[88] Roger Stewart, "Can Psychologists Measure Driving Attitudes?" Educational and Psychological Measurement, 18 (1958), pp. 63-73.

and of the motoring public. The methods employed to present have been adapted from classical psychology and sociology. Stewart reported that, "While some studies have shown changes in scores on tests designed to measure driving attitudes, no studies have shown that the changes thus produced were reflected in subsequent driving behavior . . . ."[89]

Some approaches to changing attitudes may work on one individual and not another. Future trends may be more successful in changing attitudes because of more comprehensive and systematic research into the total personality of the driver. The use of indirect and projective techniques may reveal the ego-involvement of an individual in performing the driver's task.

Interrelation of Personality and Behavior Related to Driving

It has become apparent to traffic educators that the driver can only be behaviorally segmented for purposes of study. In actual performance his psychological tendencies influence his behavior as a driver.

Perchonok and Hurst[90] studied the decision-making processes of drivers in a merging situation. For experimental purposes lane closure for merging was compared

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[89] Ibid., p. 70.

[90] Kenneth Perchonok and Paul Hurst, "Effect of Lane-Closure Signals Upon Driver Decision Making and Traffic Flow," Journal of Applied Psychology, 52, 5 (1968) pp. 410-413.

under two experimentally manipulated methods: 1) signal closure and 2) conventional closure. The decision-making model employed, permitted inferential measurement of responsiveness versus confusion and risk-taking, predisposition, as well as direct measures of risk-taking and hazard.

The information was gathered with an elevated camera placed above a three-lane section of the John C. Lodge Freeway. The difference between the conventional closure and experimental signal closure was the provision of advanced warning for the signal closure via an overhead sign 1200 feet from the exact closure. Traffic volume under the two methods was essentially the same.

The results indicated that the signal closure method, which provided earlier warning of the closure, was superior to the conventional closure in terms of lower hazard (number of small gaps accepted) and greater responseness versus confusion of the operators. The primary purpose of the signal closure was confirmed by a general improvement in traffic flow. Drivers under the signal closure exhibited a greater risk-taking predisposition--a willingness to accept smaller gaps--but their lower level of "confusion" permitted drivers to better behave in correspondence with the requirements of merging. The amount of risk was no greater under the signal closure than the conventional closure. The unexpected <u>risk-taking</u> predisposition of the signal closure group was explained by aggressive, non-aggressive behavior. Finally, it was concluded that measured "hazard" was greater under conventional closure than signal closure.

Adams and Weinstein[91] developed a device to measure the judgment of an impending hazard by a stimulus accretion technique. They constructed a device to present to a driver the problem of reacting to a test situation which duplicated the moment when a hazard was perceptible immediately ahead and a decision had to be made. The stimulus employed was a picture of a traffic hazard. Each stimulus picture was projected via a mirror to a ground glass screen held in a horizontal position before a seated subject. The picture screen was covered on top with a set of small blocks which hid the picture from view. The subject removed the blocks and as he did the picture came into view. Time pressure was induced by having the blocks removed by audible clicks of a metronome. Three scores were taken: number of blocks removed (B), number of errors of interpretation of hazard (E), and the discrepancy between time allotted by the metronome and time actually used (D_t).

The technique was first tried with a group of 16 drivers. Those drivers who accreted a relatively smaller

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[91] James Adams and Sanford Weinstein, "Measurement Judgment of Impending Hazard by a Stimulus Acceleration Technique," Synopsis of paper presented at the annual meeting of the Highway Research Board, National Academy of Sciences, January, 1965.

stimulus (low B score) and also had relatively more errors (high E score) were the drivers with higher accident rates.

This finding was tested with a second sample of 103 Peace Corps Volunteers in training for service overseas. The significantly higher accident index of the Lo Hi category (low blocks and high errors) confirmed the results of the pilot study. If a low block removal score could be interpreted as impulsive action tendency, and high error score as inaccurate judgment, then it was the impulsive inaccurate driver who was associated with high accident experience.

As a final example of the interrelation of personality and behavior related to driving, attention was directed to Bloomer's article, "Perceptual Defense and Vigilance and Driving Safety."[92] Bloomer said motor vehicle operation was a perceptual-motor response which was primarily controlled by perception of the environment. Research in perception indicated that a stimulus-target could be available, yet not attended to by the driver. Under this condition perception was selective. Selectivity in this case was because a driver had assigned priorities to the targets in his driving field. However, the phenomenon of selective perception resulted in more subtle psychological ways which could contribute to unsafe behavior.

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[92]Richard Bloomer, "Perceptual Defense and Vigilance and Driving Safety," Traffic Quarterly (October, 1962) pp. 549-558.

> Psychologists have long sought an answer to the question: What makes a person select some things to perceive and avoid seeing (perceiving) other things. One explanation is that people tend to perceive everything except those elements which they do not want to perceive. This is called perceptual defense. The alternative position is that people select certain important elements to perceive and basically ignore the rest. This explanation is called perceptual vigilance (or accentuation).[93]

Within the theoretical construct of defense and vigilance the emotional climate of the individual played an essential role. The person's perception of an event was related to his past emotional milieu. If the past perceived event was positive the individual seeked that positive emotional event in the future for reinforcement. On the other hand an individual tended not to perceive emotional negative events.

> However, many emotionally negative events, if not perceived, lead to dire consequences for the individual . . . Driving, of course, is full of just such dangerous elements with potentially negative consequences.[94]

In the application of perceptual defense in driving the closer an individual approached a hazardous event, the more negative that event became.

> Clearly the position of perceptual defense does not describe reality, for the reverse is true . . . Illustrations of perceptual defense are not so commonly recognized, since the individual does not remember elements he defends himself against.[95]

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[93] Ibid., pp. 549-550.

[94] Ibid., p. 550.

[95] Ibid., pp. 550-551.

Bloomer attempted to test the theoretical constructs of perceptual defense and vigilance in an experimental laboratory investigation. In the study Bloomer paired shock (negative emotion) with non-driving events for the subject to recognize. A control group was given the same non-driving event material but the events were not paired with electric shock. The results indicated a significant tendency for subjects to perceive the shock letter (event) more frequently than did the control group. The results further indicated that both perceptual defense and vigilance may be enduced in the same person simultaneously.

In the discussion Bloomer described general threatening stimuli which influenced all drivers, i.e. heavy traffic and bad weather. However, he stated that each driver had a series of vigilances that were specific to him, and there was not necessarily a rational relationship between the events in which a person was sensitized and the importance of the event in the driving situation.

Human Functions

The human functions required of a motor vehicle operator could be classified as part of driver characteristics. However, in this paper human functions were treated separately because the focus of driver characteristics was typically on input (vision) and output (reaction). Human functions serve as a structure for that which takes place in a cognitive form within the operator--internal to man.

In addition, the study of human functions was more task oriented and less dependent on accident research.

Information on human functions required in motor vehicle operation was sparse and generally was descriptive in nature with only single human functions treated experimentally.

As early as the 1950's, traffic safety people had been aware of the need to study the human functions required of the motor vehicle operator. This need was aptly demonstrated by the publication: The Federal Role in Highway Safety which follows in part:

> In any examination of the human factors in highway safety, there appear to be two classes of relevant characteristics. One of these is a group of factors that is required of all drivers by the very nature of driving, and includes sensory functioning, perception, judgment, analysis, decision making, integration, and translation into action. The second class comprises characteristics specific to the individual, and includes factors of intelligence, personality, emotion, and social forces.[96]

Michaels,[97] an engineering psychologist, believed that before human functions could be delineated, it was necessary to define the system in which the human operated. Once the highway transportation system was defined,

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[96]The Federal Role in Highway Safety, 86th Congress, 1st session, House Document #93, p. 30.

[97]R. M. Michaels, "Human Factors in Highway Safety," Traffic Quarterly (October, 1961), pp. 586-599.

the focus would no longer be on errors (accidents) but upon component interreaction to perform tasks. An excerpt from Michaels' article, "Human Factors in Highway Safety," provided for a descriptive presentation of what human functions he felt were important to motor vehicle operation.

> Driving requires the human to guide his vehicle. This means he must operate upon his perception. For example, if a curve is perceived while driving it is necessary to operate upon that perception to determine the corrective action that must be taken to stay on the road. Thus, some kind of analysis must be performed in order to determine the kinds of responses required. In the present example, the human is required to estimate the degree of curvature in the road, the speed that will be required to mention just a few . . . There is little doubt that driving often imposes upon the driver demands such as these which are at or near the limits of his capacities. Consequently, the highway system must function unreliably under these conditions.[98]

There are several other writers, Gibson,[99] Fox,[100] and Safren and Schlesinger[101] who described driving in terms of the human function concept. They primarily saw driving as a continuous series of integrated perceptions, judgments, and decisions which were influenced by feedback and other psychological aspects such as risk-taking.

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[98] Ibid., pp. 593-594.

[99] J. J. Gibson and L. E. Crooks, "A Theoretical Field-Analysis of Automobile Driving," The American Journal of Psychology, 51, 3 (July, 1938), pp. 453-471.

[100] B. H. Fox, Alcohol and Traffic Safety, U. S. Public Health Service Publications, No. 1043, Chapter 8.

[101] Safren and Schlesinger, Driving Skill and Its Measurement, George Washington University, Washington, D. C. (April, 1964).

Forbes[102] perhaps provided one of the more easily understood descriptions of the human functions required in driving when he stated:

> In analyzing the driver's task, we find that perception of rapidly changing situations, judgments based on these perceptions plus background knowledge, and responses adequate for each situation are the essentials.[103]

Although Forbes' description was a simplified version of driving, the human function components were identified and the interaction of the components was clear.

Human Functions: Measuring and Developing

The three primary human functions as indicated in the previous section are perception, judgment, and decision-making. From the available literature, the study of perception was emphasized most by the traffic educator with judgment receiving some attention in the research. Decision-making as it is related to driving has received little attention. References in preceding sections referred to the decision-making process in driving. For some insight into the decision-making process, the writings of Perchonok and Hurst,[104] Fox,[105] and Edwards,[106] were available.

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[102] T. W. Forbes, "Human Factors . . .," op. cit.

[103] Ibid., p. 8.

[104] Perchonok and Hurst, op. cit.

[105] Fox, op. cit.

[106] Edwards, op. cit.

Perception

The study of perception, usually, was designed to determine the number of events an observer could recognize in a limited time span. The perceptual research dealt with perception and driver records, perception and teaching methods, and perception and intellectual abilities. The perceptual research was further limited to visual perception (capability required) of the motor vehicle operator.

Spicer[107] conducted a research project in Hawaii which tested four variables, including visual perception, to distinguish between accident-repeaters and accident-free drivers. In order for Spicer to conduct his research he had to develop and construct a visual perceptual evaluation test. His test, "Visual Perception Test," consisted of motion picture footage from the area in and around Honolulu, Hawaii. In order to determine the observer's response he developed a checklist based on the films. The checklist included positive weighted items which were relevant to safe driving, negatively weighted items which were irrelevant to safe driving, and items even more negatively weighted which reflected misperceptions of the traffic situations. The "Visual Perception Test" was first administered to 26 college students. The results indicated an ineffectiveness of the test which led to a

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[107] Robert A. Spicer, Human Factors in Traffic Accidents, Research Grant No. AC-55, U. S. Public Health Service, Department of Health, Education and Welfare, Washington, D. C.

revision of the checklist. The next population tested consisted of 209 professional bus drivers. For professional drivers the "Visual Perception Test" was the only measure that significantly differentiated the accident-repeaters from the accident-free group.

The test was further refined by administering it to a group of lay people with significant results.

The final phase of Spicer's research was directed toward the adolescent operator. The sample consisted of 875 teen-age applicants for operators' licenses. The chronological age of the applicants was between 15 and 17 years. A follow-up system was employed to determine which teenagers in this study were involved in reportable accidents. The results of the "Visual Perception Test" allowed the investigator to distinguish exhibited behavior that resulted in adolescent accidents.

In summary the four variables investigated by Spicer were attitudes, frustration response, problem solving, and visual perception. His findings indicated that only visual perception significantly differentiated the accident-repeater from the accident-free driver for the population studied.

McPherson and Kenel[108] investigated the perceptual ability of in-school youth prior to licensing. The

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[108]Kenard McPherson and Francis Kenel, "Perception of Traffic Hazards: A Comparative Study," Traffic Safety Research Review, 12, 2 (June, 1968), pp. 46-49.

researchers employed three different I.Q. groups. Perceptual training was conducted in driving simulators with each group receiving the same amount of instructional time.

In order to measure the perceptual difference of the sample groups, a perception test and evaluation checklist had to be developed. The "Perception of Traffic Hazards Test" was constructed from the Shell Filmstrip series. In the test development hazards and pseudo-hazards were identified by expert judges. The scoring procedure for the "Perception of Traffic Hazards Test" follows:

> Different hazards present a different apparent danger to a driver so the identified hazards were assigned a positive numerical value +1 to +3 depending on the severity of the hazards. Since the pseudo-hazards must be of a discrete nature in order to be a worthwhile distractor, they were assigned a negative numerical value of -2 or -3. A student's raw score on either the pre-or post-test was the difference between his perception of actual hazards and pseudo-hazards. For the pre-test, the total positive points were 80 and the total negative points were 46. For the post-test the total positive points were 79, with a total of 29 negative points. A multiple-choice answer sheet was used. The student merely placed an "x" by the choice designated A-E. The responses to the test were pre-recorded on tape. By employing this method, all participants received the same auditory cues and hence were not influenced by inflections of the voice or by facial expressions of the examiner.[109]

The investigators concluded that:

1. Traffic simulators provided a method to improve a student's visual perceptual ability in identifying traffic hazards.

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[109] _Ibid_., p. 47.

2. Those students who received instruction (experimental group) did better on the post-treatment on the "Perception of Traffic Hazards Test" than did the students who did not receive instruction (control group).

3. Traffic simulator instruction provided a means (method) of improving a student's ability to perceive traffic hazards regardless of his measured I.Q.

4. Although there was some apparent need to group students for traffic simulator instruction on the basis of measured I.Q., no statistical significant differences in growth of experimental groups existed when comparing one experimental group with the other.

Robinson,[110] in a study employing the same evaluation device, "Perception of Traffic Hazards Test," compared the influence of two traffic simulated methods on the subject's visual perception. He attempted to determine:

1. If there was a significant improvement in visual perception of traffic hazards when providing instruction by a simulated method (using traffic simulator programmed instructional films in a classroom).

2. If there was a difference in visual perceptual development when comparing simulated method (1) above with the conventional usage of driving simulators.

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[110] Allen Robinson, The Influence of Programmed Instructional Films on Perception of Traffic Hazards, an unpublished master's thesis, Illinois State University, June, 1968, 58 pages.

The two groups received instruction over the same traffic simulator films and were given the same amount of instructional time.

The researcher concluded that:

1. visual perceptual ability required to identify hazards and events could be developed by employing the simulated method of using traffic simulator films in a typical classroom setting, and

2. that there was no significant difference in measured perceptual ability as developed by the two simulated methods--the typical classroom treatment as compared with the conventional traffic simulator method.

Streeter[111] developed a classroom visual training approach. In his program the sample was presented static input through a tachistoscopic technique. The visual perception instructional program consisted of 18 lessons of 26 minutes in duration. He employed the "Perception of Traffic Hazards Test" as the measuring device. Streeter concluded that visual perceptual ability could be improved and developed in a classroom setting employing static input. He further stated that visual perceptual training could be accomplished without expensive sophisticated apparatus (simulators).

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[111]Gerald Streeter, A Classroom Visual Perception Program for Beginning Motorists, an unpublished master's thesis, Illinois State University, August, 1968, 42 pages.

Judgment

The research concerning judgmental ability of the operator focused on the components of speed and distance, the two primary factors which provide for an operator's safe field of travel.

Olson, et al.[112] reported that a driver was continuously faced with the problem of determining the velocities of other vehicles in relation to his own speed, and that no one had attempted to verify experimentally the cause for errors in the driver's judgment of speed. They further indicated that there was a need to assess the ability of people to make relative velocity judgments.

> The purpose of this investigation was twofold. First, to learn how accurately drivers can determine whether the gap between their own and a preceding car was opening, holding constant, or closing. Second to determine how well drivers can discriminate among different rates of change of this gap.[113]

Twelve experienced drivers participated in the experiment. They were passenger-judges in a vehicle which travelled at a constant speed of 40 miles per hour. The lead car in which the subjects were to base their judgments on, travelled at a speed from ten to seventy miles per hour and changed speed in ten mile per hour intervals. Communication was maintained between the vehicles with

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[112]Paul Olson, et al., "Driver Judgments of Relative Car Velocities," Journal of Applied Psychology, 45, 3 (1961), pp. 161-164.

[113]Ibid., p. 161.

portable short-wave radios. On signal, the participants in the subject-vehicle were directed to look-up and observe the lead vehicle for seven seconds. The subject's judgments were made during the observation time. There were 154 judgments made, 62 were correct and 92 were incorrect. Of the 92 incorrect responses, 62 were conservative responses indicating the judge underestimated the speed of the lead car.

The researchers made the following conclusions, based on the data collected:

> 1. In the range of speed differences tested, people tend to be quite accurate in determining whether the distance between their car and a preceding one is increasing or decreasing.
>
> 2. People exhibit a better than chance ability to discriminate between opening and closing rates at least as fine as 10 mph.
>
> 3. The accuracy with which judgments such as these can be made increases as the distance between the vehicles decreases.
>
> 4. Judgments are made more accurately when the gap is closing than when it is opening.
>
> 5. In the range of speed differences studied, subjects tended to underestimate the relative speed differential between their car and the one in front of it.[114]

It appeared that people do rather well in making the type of judgments required in this study. There was little reason to believe that frequent dangerous driver actions

[114] *Ibid.*, pp. 163-164.

would result because of information supplied by this type of judgment.

Wright and Sleight[115] conducted a study to investigate following distance behavior associated with mental sets and the use of additional visual cues in maintaining following distance. This approach primarily allowed drivers to judge the amount of headway available for manueverability.

Two vehicles were employed in the investigation. The lead vehicle controlled speed of travel and the follower-vehicle controlled distance (headway) on the basis of pre-trial instructions. The distances were measured by a motion picture camera mounted on the front of the follower vehicle.[116] The sample consisted of 26 subjects which were predominantly male.

The sets that were induced by the researchers were habitual, maximum safety, and emergency. The investigators concluded on the basis of the sample employed:

> 1. Following distance is a stable measure of driving performance.
>
> 2. Both speed and emergency instructions affected following distance, with the higher speed resulting in longer distances and the emergency mental set resulting in shorter distances.

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[115]Stuart Wright and Robert Sleight, "Influence of Mental Set and Distance Judgment Aids on Following Distance," Highway Research Board Bulletin, No. 30, 1962.

[116]T. F. Forbes, *et al.*, Measurement of Drivers Reactions to Tunnel Conditions," ARB Proc., 37 (1958), pp. 345-357.

3. Percent of error was significantly less at the longer of the two requested following distances.

4. Use of the visual and timing aids resulted in significantly lessening the tendency to follow at a greater than requested distance.

5. On the average, drivers drove at about the same following distance under both habitual and maximum safety instruction, at 30 mph.[117]

Particularly significant for this study was the fact that at both 30 and 50 mph subject drivers made the judgment that their habitual following distance was equal to the set of maximum safety.

Task Analysis and Requirements

Few attempts have been made to describe and analyze the task of the motor vehicle operator. Task analyses which have been completed were treated in one of two approaches. Some driving tasks were treated in a descriptive manner and others have been organized and constructed into schematic models. Frequently, tasks were not developed as comprehensive statements of the requirements for motor vehicle operation, but were designed to provide focus or perspective for research purposes. In many analyses the authors were aware of the limitations of the task models and identified the limitations.

The historical concept of the driving task was developed by Gibson and Crooks.[118] They developed a

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[117]Wright and Sleight, op. cit., p. 59.

[118]Gibson and Crooks, op. cit.

description of the task based on a systematic set of concepts which was felt to have both psychological and practical validity for automobile operation. Gibson and Crooks felt that driving an automobile was predominantly a perceptual task, with overt behavior being relatively simple and easily learned. They further recognized and developed their concept within the constraints of what man could do with a tool (vehicle) for locomotion. According to the authors an operator was limited to speed and direction change. Hence he manipulated his vehicle controls in an effort to achieve a field of travel and maintain a minimum stopping zone.

Prior to a description of "the field of safe travel" and "minimum stopping zone," Gibson and Crooks asked the basic question: "What initiates and maintains locomotion itself."[119] In answering the question, they purported that speed of locomotion was a function of the individual's desire to arrive at his destination. This desire was represented by the hurry motive. When people were not motivated by hurry or destination arrival then driving was considered pleasure: ". . . the using of a tool or a skill for its own sake."[120] Acceleration then was a function of a motive of either hurry or destination arrival or both. Deceleration was, however, an avoidance

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[119]Ibid., p. 456.

[120]Ibid., p. 456.

reaction to obstacles which ultimately supported the motive of destination arrival. The human response of steering was defined as follows: ". . . a perceptually governed series of reactions by the driver of such a sort as to keep the car headed into the middle of the field of safe travel."[121]

According to Gibson and Crooks, the field of safe travel was visually attended. The attending involved a process of selecting pertinent events to locomotion while not selecting non-pertinent events. The field was defined as ". . . the field of possible paths which the car may take unimpeded."[122] The field of safe travel perceptually had a positive valence. However, within the total road system both positive and negative valences existed. "For instance, a hot-dog wagon had a negative valence with respect to locomotion, but a positive one with respect to appetite."[123] Further the field was a spatial field but was not physically fixed. That is to say the roadway shoulder which was generally conceived as possessing a negative valence acquired a positive valence in an emergency situation.

Gibson and Crooks identified the minimum stopping zone as the second component of automobile driving. The

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[121] Ibid., p. 456.

[122] Ibid., p. 454.

[123] Ibid., p. 455.

size of the minimum stopping zone was dependent on vehicle speed and other vehicle and road factors. The minimum stopping zone also covered less physical space than the field of safe travel.

In summary, Gibson and Crooks defined driving as a perceptual task and perceptual field dependent task. The task was directed by motive and was individual and competitive in nature. Successful task performance was measured by the product of human functions, perceptual response, resulting in a safe field of travel or a minimum stopping zone.

A second model was developed by Schlesinger and Safren,[124] and was further refined by Schlesinger.[125] Their model relied largely on the historical model. Schlesinger and Safren viewed motor vehicle operation as a form of locomotion which was guided by perception, especially visual perception, so that paths were identified within the perceptual field which led to a collision-free destination. Visual perception was considered more important than motor responses which were easily mastered and invariant. The objective visual field of the driver was constantly changing and required continuous organization

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[124] L. E. Schlesinger and M. A. Safren, "Perceptual Analysis of the Driving Task," Highway Research Board Record 84 (January, 1964), pp. 54-61.

[125] L. Schlesinger, "Objectives, Methods, and Criterion Test in Driver Training," Traffic Safety Research Review, 11, 1 (March, 1967), pp. 18-24.

by the operator. "On the basis of this organization, the driver is seen as making compensatory motor responses to the vehicle in the form of speed and direction changes."[126]

Decision-making was viewed as that part of the model which enabled the operator to select from alternatives the correct response for driving situations.

In both Schlesinger and Safren and Schlesinger's articles, the driving process was described in terms of critical tasks to be performed by an operator and behaviors which were prerequisites for performing the tasks.

In part, the critical task requirements were:

> 1. The perceptual organization from moment to moment a path or series of paths, the 'field of safe travel,' where the driver can move without colliding with obstacles or leaving the roadway . . . should be in reasonable accord with objective reality.
>
> 2. The perceptual organization from moment to moment of the smallest region within which the driver could come to a full stop if necessary, the 'minimum stopping zone,' . . . should also be in reasonable accord with reality . . .
>
> 3. The comparison of these two fields in order to assess the optimal state . . . The driver maintains a field of safe travel greater than the minimum stopping zone . . .
>
> 4. The translation of the overall route leading to the destination into a series of momentary courses to follow, with planning far enough in advance so that at any instant the course lies within the field of safe travel . . .

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[126] Schlesinger and Safren, op. cit., p. 55.

> 5. While carrying out the tasks . . . a driver is continually making compensatory changes in the car's direction and speed to achieve an optimal state . . .[127, 128]

Schlesinger then identified what he called procedures, i.e., passing, stopping, etc., but indicated that an analysis should not be confined to the driving situation alone, but the behaviors (human functions) of the operator in relation to the situations.

He delineated two broad classifications of driving behavior--guidance and control. The driving behavior classes were further delineated into required human functions.

The first class, guidance behavior, was sub-divided into three sub-tasks (functions); search, identification, and prediction. They were all perceptually derived functions:

> . . . These sub-tasks tell the driver where and when to look, what to look for and what to make of it. They answer the questions: Is anything going on that should influence my driving? What is it? What can be expected to happen?[129]

The control behavior was divided into two sub-tasks (functions), decision-making and execution. "Decision-making procedures were concerned with the question of what

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[127] Ibid., pp. 55-56.

[128] Schlesinger, op. cit., pp. 18-19.

[129] Ibid., p. 19.

to do, and execution . . . with the drivers responses to the vehicle."[130]

Schlesinger and Safren then viewed the operator's role as a task of attending to a continuously changing perceptual field which could be successfully transversed to a destination by employing two broad classes of behavior--guidance and control.

Ross[131] developed driving models to explain the causes of highway collisions. He stated that driving was a process which could be conceptualized by the interaction of operator-vehicle and road. He further indicated that the possibility of failure existed in the simplest of driving tasks. Ross said:

> The task of driving is to get cargo to a spatio-temporal goal. The cargo may be people, goods or both. The goal is arrival at a geographical location within some limited period of time, although the location may be stated broadly (e.g. 'the country') and the time limits may be very flexible (e.g. 'this afternoon').[132]

Ross' first model was a non-social model in which the operator was seen to guide his vehicle with no other operator-vehicle units on the road. The second was a social model, a more realistic model, which added the presence of other highway users.

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[130] Ibid., p. 19.

[131] H. L. Ross, Schematic Analysis of the Driving Situation, Traffic Institute, Northwestern University, 1960.

[132] Ibid., pp. 12-14.

The simple non-social model could result in failures because of conditions external to the basic system (man-machine-road). Such events as moisture, surface, and markings could vary which result in failure.

The operator in the social model was more likely to experience accidents because of the presence of additional vehicle-operator units operating independently to achieve independent goals.

> As vehicles travel over a roadway network in different directions and at different velocities, an operator must be able to predict the behavior of all other drivers during the period in which there is a relatively high probability of their becoming obstacles in the path.[133]

In order to make these predictions an operator needed to make certain assumptions. In the social model these assumptions were based primarily on rules of the road.

Ross viewed the driving process as being motivated by a desire to arrive at a destination within a specific time limitation. In functioning as an operator an individual was operating simultaneously with other independent goal oriented operators. Thus the task of driving in the social model was complicated with a high probability of failure.

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[133] Ibid., pp. 12-15.

Forbes[134, 135, 136] identified in several articles the human functions required in performing the driving task, and developed a schematic model to illustrate his concept of the driving process. He analyzed the driving task in terms of perceptions, judgments, and responses.

> In analyzing the driver's task, we find that perception of rapidly changing situations, judgments based on these perceptions plus background knowledge, and responses adequate for each situation are the essentials. The judgments made by the driver are based upon information about the highway situation and about possible hazards which may be so well learned that it is automatically rather than consciously used.[137]

Knowledge, attitudes and motivations also influenced driver reactions.

Forbes' diagram in Figure 1 provided for the study of a number of functions. However, Forbes stated that the analysis was an oversimplification of the driving task.

Platt[138, 139] measured the probability of events in highway situations, and his analysis has been employed by

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[134] T. W. Forbes, "Human Factors . . .," op. cit.

[135] T. W. Forbes, "Traffic Engineers and Driver Behavior," Traffic Safety Research Review, 9,3 (September, 1965), pp. 87-89.

[136] T. W. Forbes, "Predicting Attention-Gaining Characteristics of Highway Traffic Signs: Measurement Technique," Human Factors, 6, 4 (August, 1964), pp. 371-375.

[137] T. W. Forbes, "Human Factors . . .," op. cit., p. 8.

[138] Fletcher Platt, "Operations . . .," op. cit.

[139] Fletcher Platt, A Unique Method of Measuring Road, Traffic, Vehicle and Driver Characteristics, presented at the IV World Meeting of International Road Federation, Madrid, October 14-20, 1962.

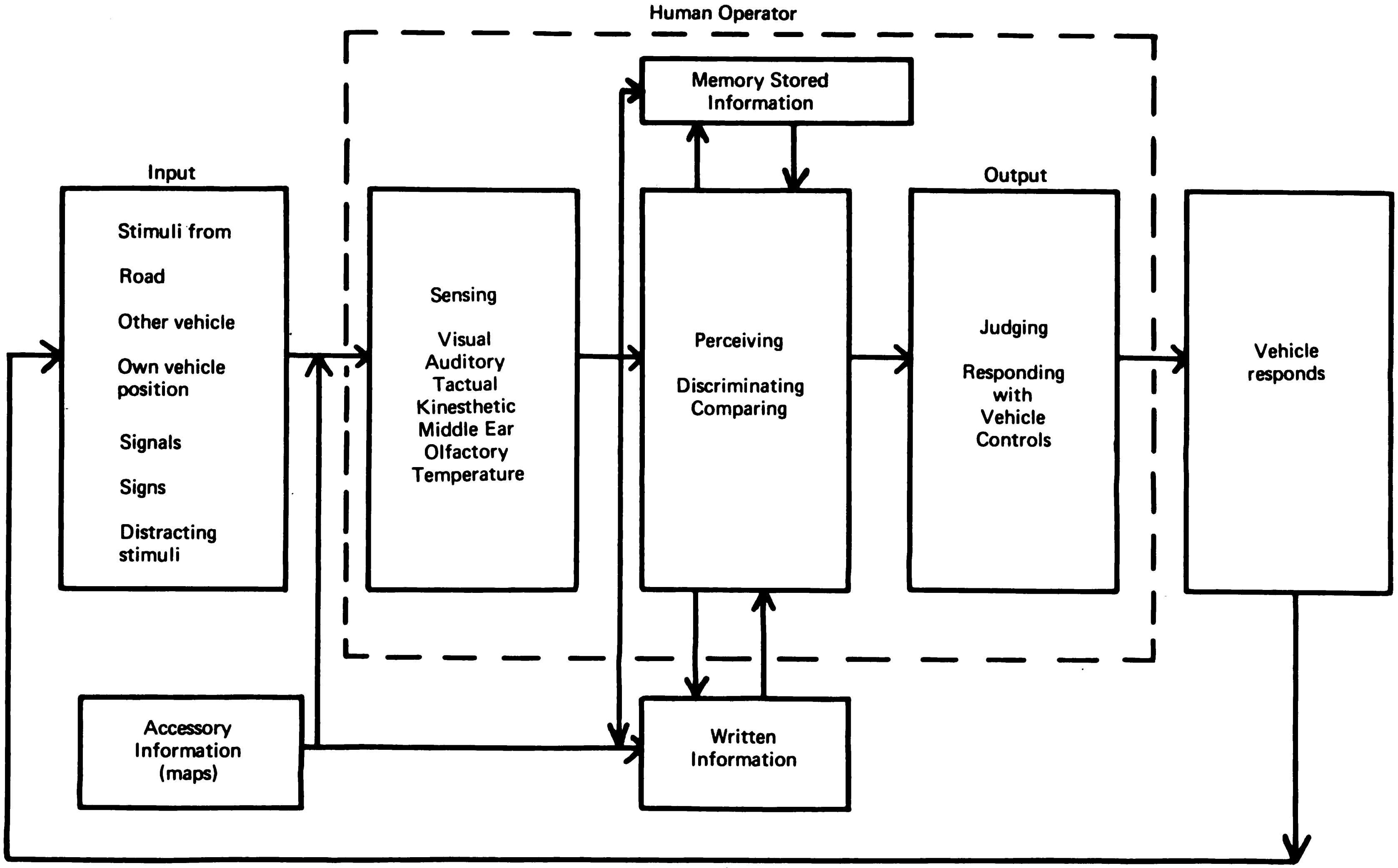

Figure 1.--Man-machine-environment analysis.[140]

[140] T. W. Forbes, "Traffic Engineers. . .," *op. cit.* p. 88.

many educators as a model of the driving task. Platt recorded the frequency and total number of events occurring as an operator moved along the roadway. He further identified required driver responses appropriate for coping with events. His data was gathered in an instrumented vehicle (Drivometer) in conjunction with a 16 mm camera with both a front and rear view.

Platt stated that a driver was confronted with a variety of events as he moved along the road. The operator observed some events and from the observations he reached a decision. The decision was in regard to vehicle control and communication between vehicle-operator units. As a result of the operator's decision, action was taken which resulted in a space-time relationship of the operator vehicle unit through direction and speed control. If the operator committed an error the probability of failure was increased. Platt indicated that errors resulted from incorrect decisions, unobserved events, or chance.

He concluded that the probability of a traffic situation occurring was as follows:

Highway and Traffic Events
- 10 or more per second

Driver Observation
- 2 or more per second

Driver Decision
- 1 to 3 per second

Driver Actions
- 30 to 120 per minute

Driver Errors
- at least 1 every 2 minutes

A Hazardous Situation
- every hour or two

A Near Collision
- once or twice a month

A Collision
- every six years of driving

An Injury
- every 40 years of driving

A Fatality
- every 1,600 years of driving[141]

In addition, Platt described the behavior of drivers and developed a schematic model (Figure 2) of the behavior of a motor vehicle operator.

Platt also defined driving as a process with four conditions or functions from input to output:

> -Stimuli (events) are some form of physical energy which activates receptors.
> -Receptors or sensory processes (observations) are classified in eleven or more sense models such as vision, audition, etc.
> -Perceptions (decisions) derived from sensations, are guides to behavior.
> -Responses (actions) are derived from perceptions.[142]

In summary Platt, described driving as primarily a visual observation task in which the operator made related driver observations of highway and traffic events. Perception, in his model, was the predominate human function required of the operator.

Staff members of the Traffic and Safety Education Section at Illinois State University developed a description and schematic model of the driving task. The schematic model relied extensively on Platt's previous

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[141] *Ibid.*, p. 3.

[142] Platt, "Operations . . .," *op. cit.*, p. 18.

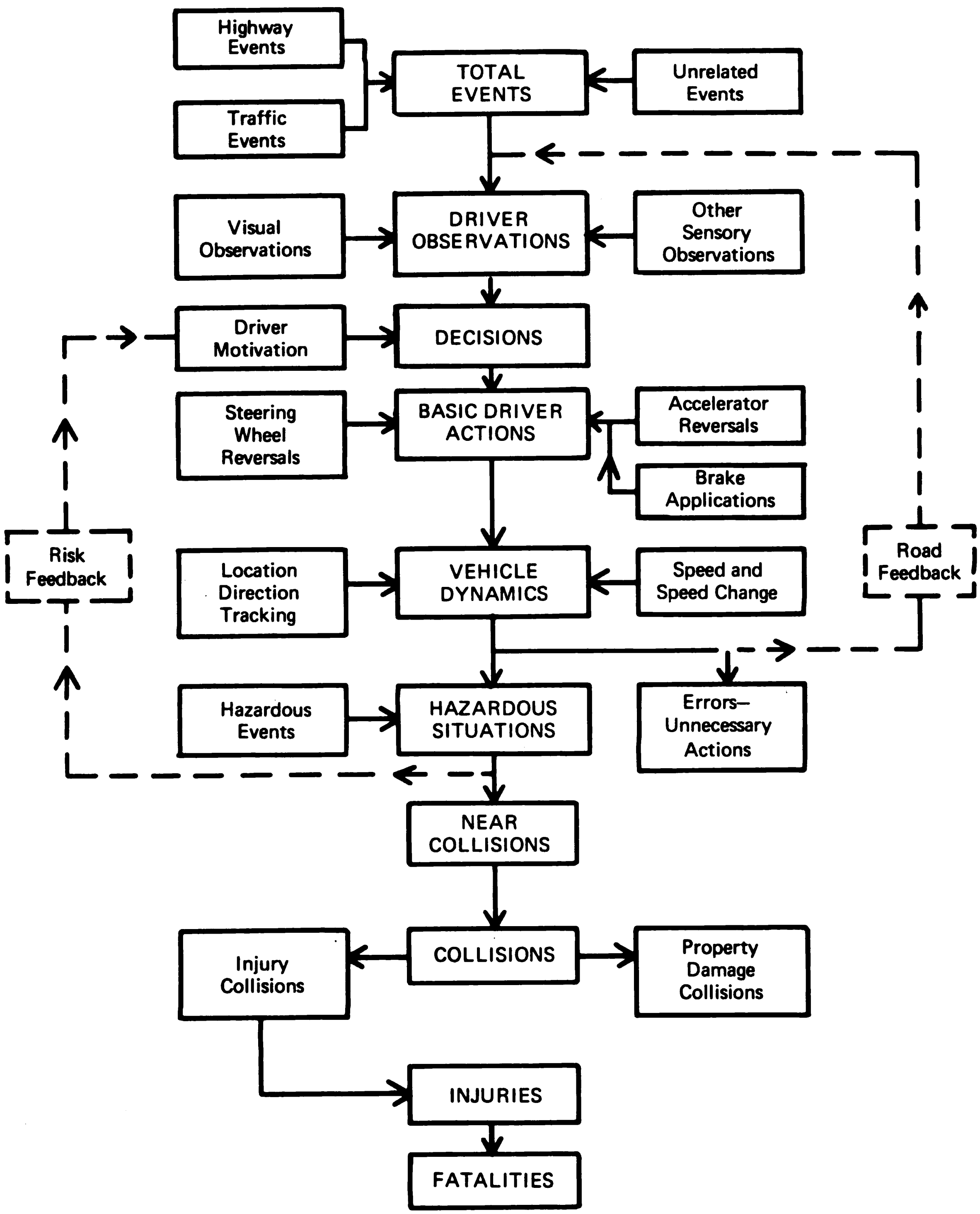

Figure 2.--Schematic diagram of highway traffic situations.[143]

[143]Platt, A Unique. . ., op. cit., p. 2.

efforts in task analysis. The task description classified driving as a mental, social, and physical task and identified the performance required of an automobile operator.

> Driving an automobile consists of making 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.[144]

The schematic (Figure 3), which follows, identified behavior required from input to output. Driving success in this model was dependent upon stored knowledge, a motivated operator, and information processing.

Goeller[145] constructed a driving task model within a highway accident prevention frame of reference. The accident model was designed in a temporal ordered series of phases. The temporal sequence series included a pre-accident stage, intra-accident stage, and post-accident stage. The pre-accident stage was further sub-divided and was the structure within which the driving task was located. "The pre-accident stage consists of four phases: Predispositions, initiation, juxaposition, and evasion."[146]

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[144] ________, Description of the Driving Task, Illinois State University, undated and unpublished, p. 1.

[145] B. F. Goeller, Modeling the Traffic-Safety System, Rand Corporation, Santa Monica, California, April, 1968.

[146] Ibid., p. 13.

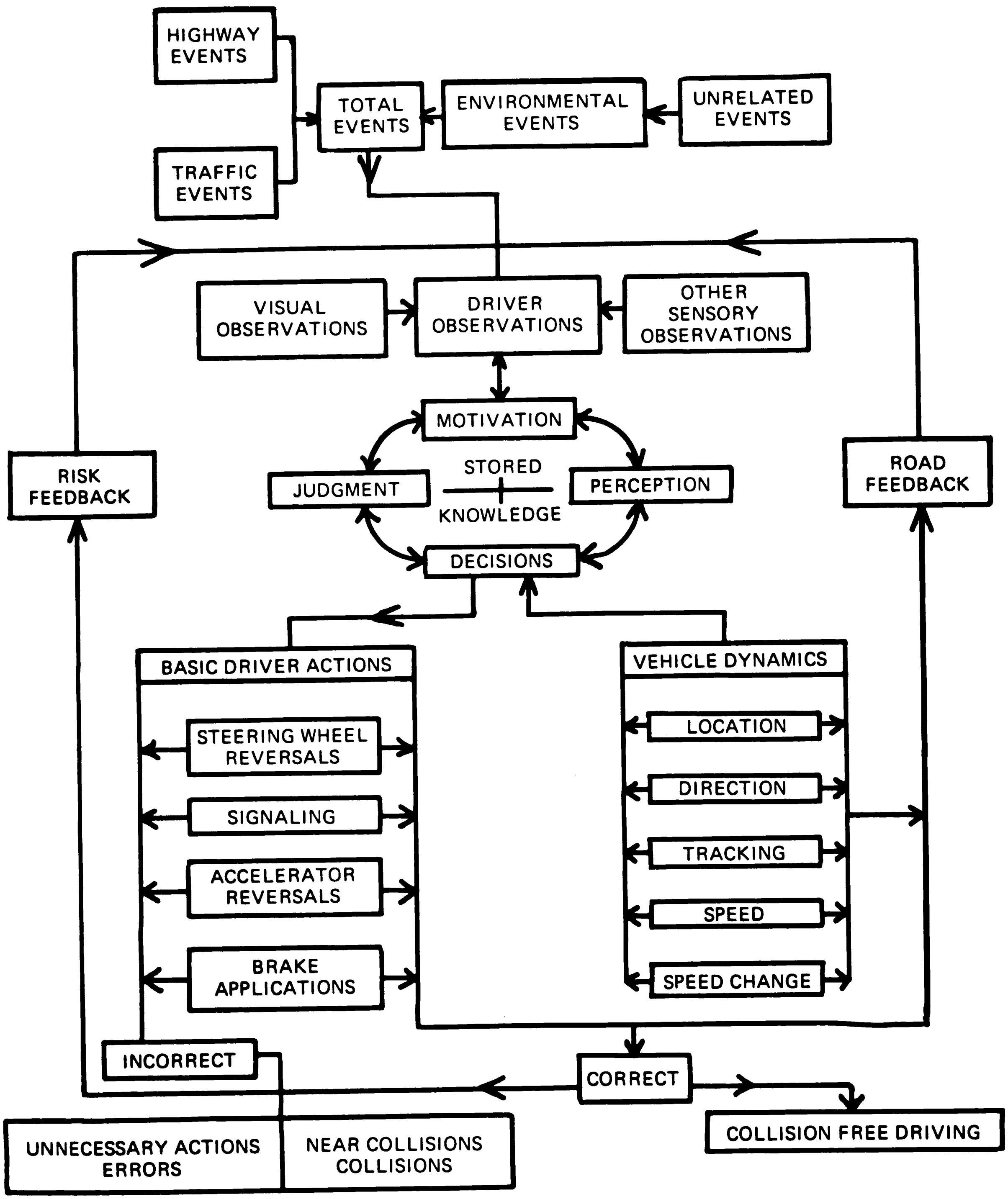

Figure 3.--The driving task.[147]

[147]*Ibid.*, p. 2.

The driving task was actually developed from the initiation phase (Figure 4). The model relied on Platt's analysis, but added additional concepts especially risk, hazard, and vulnerability.

Goeller has delineated driving in terms of the human functions required including observation, perception, judgment, decision-making, and response.

Briggs[148] studied the automobile operator as an information processor and controller in the operator-vehicle-highway system.

> The driver . . . is an information processor. He must detect a variety of visual, auditory, and proprioceptive signals and process them in order to generate movements of the steering wheel, accelerator, and brake pedals.[149]

Briggs, however, explained that the driver was not a simple transmitter, but that his behind the wheel task was most complex. Briggs considered the information processing task to be both intermittent and continuous, with both aspects being interrelated (Figure 5). In addition, the operator developed strategies for selecting information as he moved along the roadway. The operator then terminated with decisions and actions only to be recycled by a feedback loop.

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[148]George Briggs, "Driving as a Skilled Performance," Driver Behavior, Proceedings of the Second Annual Traffic Safety Research Symposium of the Automobile Insurance Industry, Insurance Institute for Highway Safety.

[149]*Ibid.*, p. 124.

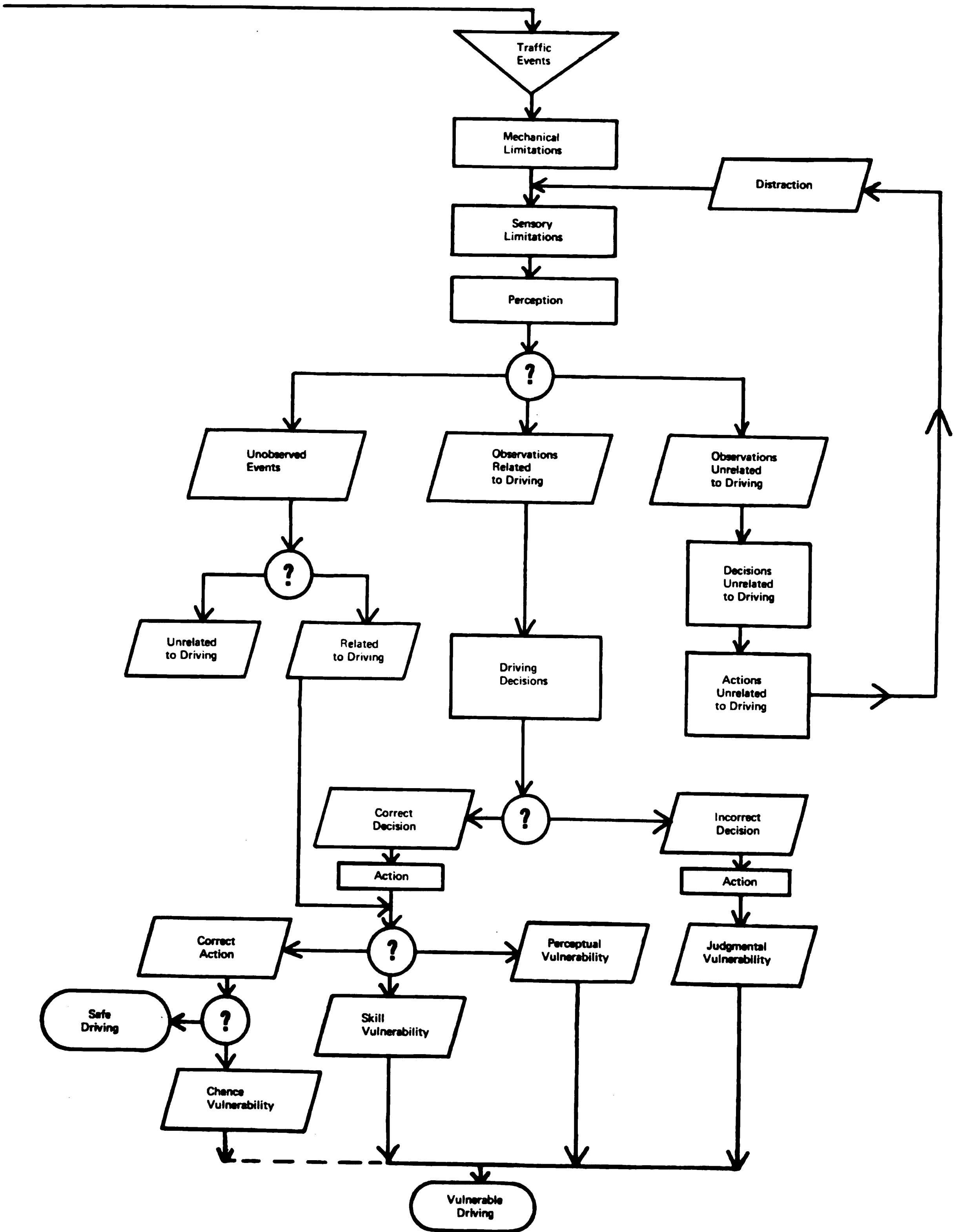

Figure 4.--Initiation phase.[150]

[150]Goeller, op. cit., p. 17.

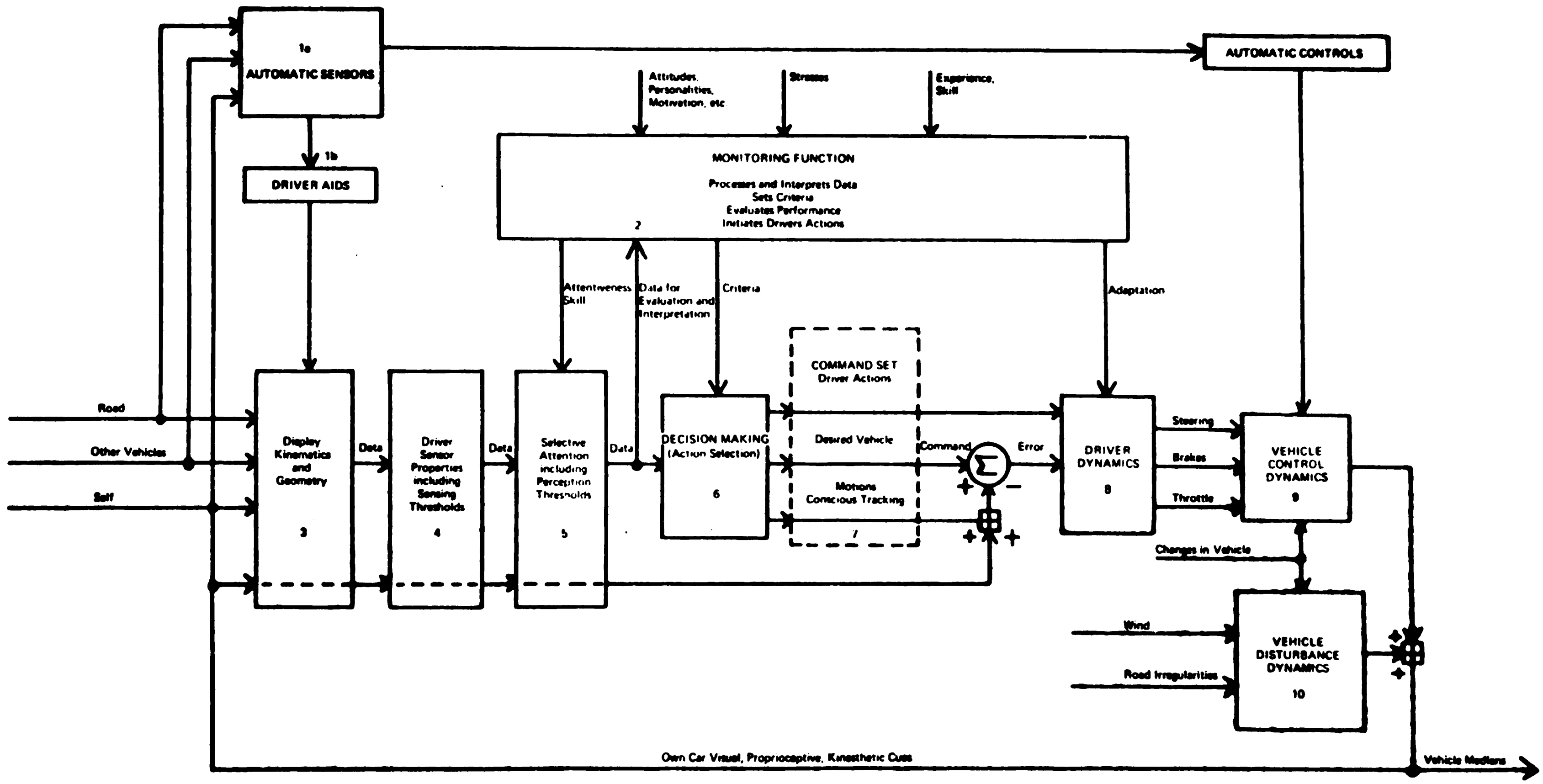

Figure 5.--A block diagram of driver functions.[151]

[151]Briggs, op. cit., p. 132.

Senders, et al.[152] also constructed a mathematical uncertainty information processing model of the driving task on which Briggs based parts of his task analysis.

Michaels'[153] concept of the driving task was essentially an information processing task which emphasized those aspects which over-load human capability. ". . . it is the ways in which the demands of the task are adapted to the characteristics of the human being that will determine the safety or reliability of the highway transport system."[154] Michaels purported that the behavior required of the human operator by the driving task was tremendously complex. He indicated that driving required sensing, perception, analysis, estimation, and problem solving which could all be classified into a guidance concept. Thus for Michaels, the driving task was a guidance task.

Christner[155] developed a task model with an information processing and communication perspective. The analysis was partitioned into three levels (Figure 6). In Level

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[152] Senders, et al., An Investigation of Automobile Driver Information Processing Final Report, U. S. Department of Commerce, The Bureau of Public Roads, Washington, D. C., April 26, 1966.

[153] Michaels, op. cit.

[154] Michaels, op. cit., p. 591.

[155] C. A. Christner and Horace W. Ray, Final Report on Human Factors in Highway Traffic: Intervehicular Communication to Bureau of Public Roads, Battelle Memorial Institute, Columbus, Ohio, 1961.

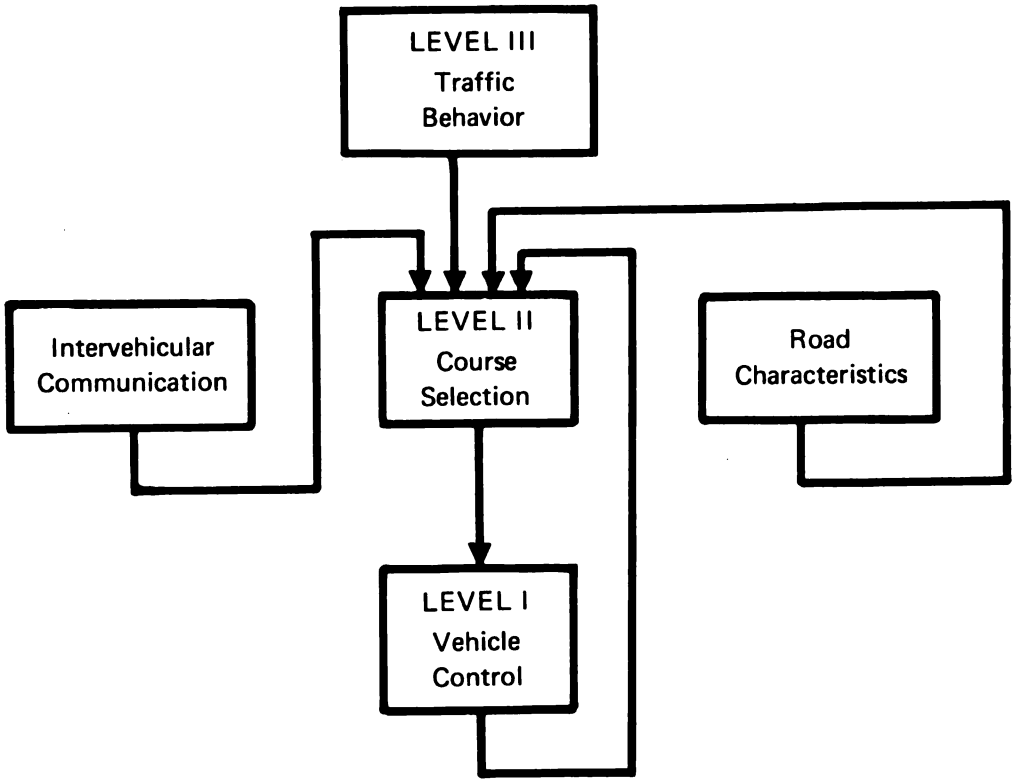

Figure 6.--General concept of the problem: A three level partitioning.[156]

[156]Ibid., p. 5.

I it was assumed that the vehicle would respond without error to the operator's control efforts. Level III, traffic behavior, was designated the responsibility of the engineer. Level II dealt with the individual operator performing with other highway users with special focus upon that individual's information processing and decision-making ability. The operator's task was to select a course within given traffic patterns and the constraints imposed by the configuration of the roadway.

> Perhaps the key notion underlying our approach to the problem is that the human being has a limited channel capacity for information processing . . . as load increases, the driver makes the following kinds of responses: (1) Restrictive filtering (2) Elimination of tasks (3) Concentration on the immediate demands of the situation (4) Increasing lag time (5) Missed data (6) Incorrect responses (7) Increased accident probability.[157]

Within Level II the operator's major task was the determination of the route and route cues (perception), determination of alternatives within the roadway (judgment) and determination of direction of other road users (judgment).

Christner, then, defined driving in terms of information processing and communication tasks, with both tasks relying on the human functions of perception and judgment.

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[157]*Ibid.*, pp. 6-7.

Lybrand et al.[158] developed a task model to evaluate driver education as an accident countermeasure. They reported that the driving task objectives were:

1. To move the vehicle from one location to another location within specified time limits;

2. on defined roadways;

3. in paths and velocities coordinated with paths and velocities of other independently controlled vehicles and pedestrians on the roadways;

4. without collision with other vehicles or pedestrians on or near the roadways, or with fixed objects near the roadways;

5. within the bounds of applicable operational rules of the motor vehicle transportation subsystem (laws and prudential norms).[159]

Proceeding from the objectives of the task, Lybrand et al., then divided driving into driving modes or driver's tasks which included open road driving, entering and leaving traffic, and traffic flow task. The modes served as a broad descriptive classification of the driving process. Following the construction of the objectives and modes, a functional analysis of driving performance was developed.

The functional analysis (Figure 7) was based on the concept that motor vehicle operation was primarily a guidance task. On the basis of perception and effect of perceptions, the operator strived for spatial-distance

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[158] Lybrand, et al., A Study on Evaluation of Driver Education, The American University, Volume 1 of 1, July 31, 1968.

[159] Ibid., pp. 59-60.

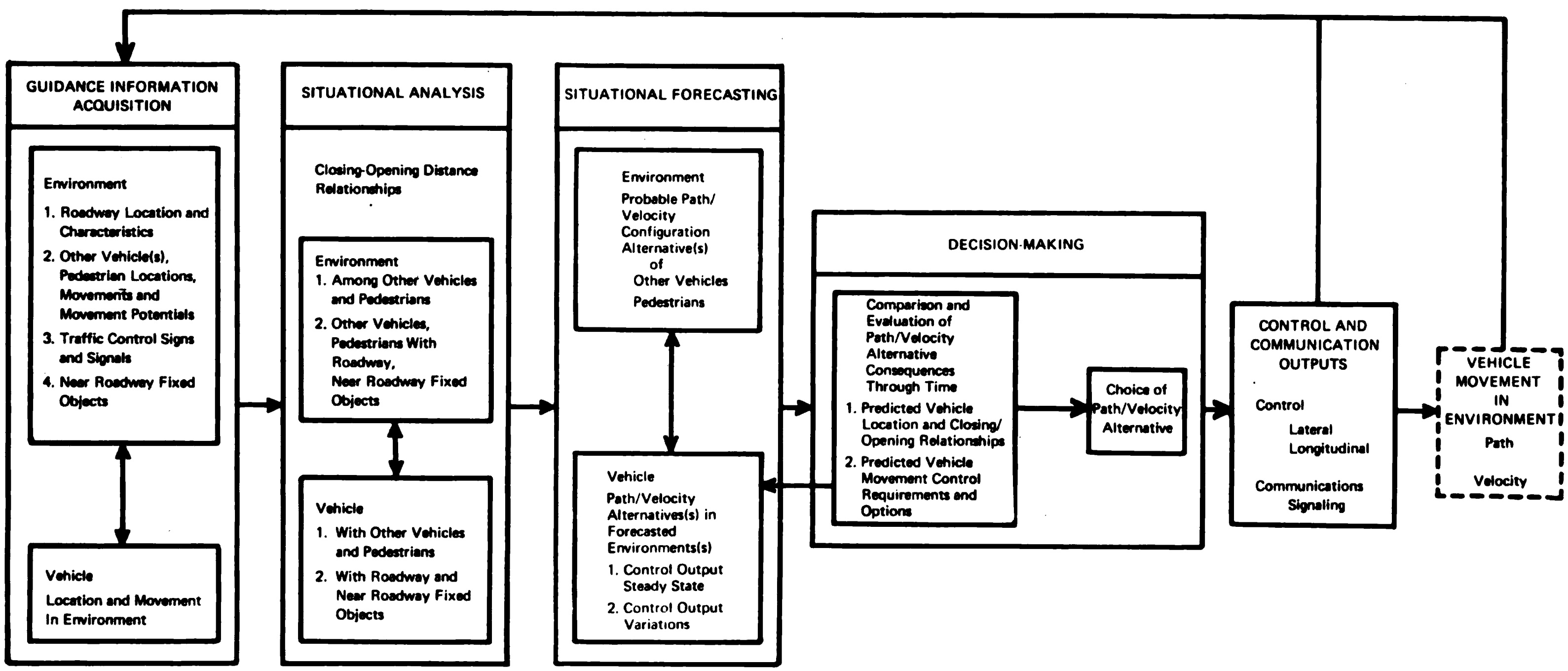

Figure 7.--Schematic representation operator functions in vehicle movement tasks.[160]

[160] Ibid., pp. 110-111.

relationships with other highway users and the environment. A major aspect which contributed to the difficulty of the operator's task was that the spatial-distance relationship was continuously changing. In light of the changing space concept, the driver's task required judgment, a second human function. The driver was required to forecast and predict what would be as well as perceive what was. The guidance function was further delineated and classified (Figure 7) into the areas of guidance information acquisition, situational analysis, situational forecasting, decision-making, and control and communication outputs.

The final driving task model was developed by Smith and Cummings.[161] Smith and Cummings viewed driving as a visual task. The successful use of visual techniques by an operator was to result in accident free driving. The model was constructed on the premise that drivers needed to be taught how to see and what to look for. Three primary seeing rules served as the core concept. They were: (1) get the big picture (2) keep your eyes moving, and (3) make sure other highway users see you. These rules were based on guidance requirements which included: centering the line of sight, comprehensive viewing, and scanning. By employing these seeing techniques, operators

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[161] H. L. Smith and J. J. Cummings, "Let's Teach Drivers How to See," Traffic Digest and Review, 4 (March, 1956), pp. 7-13.

could limit distractions and avoid the basic conflicts in motor vehicle operation.

Summary

A review of the models indicated that the driving process was broadly conceived as a varying task. The driving tasks were viewed as decision-making tasks, control tasks, guidance tasks, observation tasks, perceptual tasks, visual tasks, or as information processing tasks.

CHAPTER III

CURRICULUM AND MODEL DEVELOPMENT

In the preceding chapter a review of literature covered several topics related to driving and traffic education instruction. This chapter contains: (1) the structure for developing traffic education instructional curricular models; (2) the identification of the expert judges and the task of the judges; and (3) the curricular models.

The Developmental Structure

As a result of the standards promulgated by the National Highway Safety Bureau, current criticism of the benefits of driver education instruction, and a desire to have a better traffic education curriculum for youth, this traffic education curriculum project was undertaken. The study was designed in two parts. Part one consisted of: (1) the identification of objectives of the highway transportation system and the objectives of traffic education instruction; (2) a model depicting the major sub-tasks of an automobile operator; (3) a model and description of the general abilities required of beginning automobile operators in driving situations; (4) a model and description of the interaction between psychological factors and general driving abilities; (5) the identification of the major support systems influencing driver behavior; and (6) a curricular model delineating major instructional units in driver education. In summary part one consists of the curricular models.

Part one was evaluated by expert judges to determine the validity of the concepts employed as a foundation for traffic education curriculum development.

Part two was based on the conceptual structure and models developed in part one. Part two, the course of study, consisted of guiding educational objectives and laboratory and classroom content to be used by teachers of beginning motorists. The objectives and content were developed by the researcher. The educational objectives and the content were based on the six sub-components developed in part one. Further the interaction or inter-relation between the classroom and laboratory content was identified to demonstrate the feasibility of traffic education as a total experience. This part, the course of study, is reported in Chapter IV. Chapter IV also contains pertinent observations of the judges' review of part one which pertains to part two, the course of study.

The Tasks of the Judges

The expert judges reviewed the models for curricular development contained in part one. The three judges were selected because of their broad experiences in highway traffic safety. Three alternate judges were also selected. The titles, degrees held, contributions, and years of experience or related experience in highway traffic safety of the primary judges follows:

Judge I was Warren P. Quensel of Illinois. He is an Assistant Professor of Traffic and Safety Education at Illinois State University, Normal, Illinois. Mr. Quensel holds a Bachelor of Science and a Master of Science in education and has earned 30 semester hours beyond the Master's Degree. Quensel has taught in the public schools and two universities in traffic and safety education. He has also served as the Assistant Director of Safety and Driver Education for the Office of the Superintendent of Public Instruction in Illinois. He was in charge of traffic education curriculum construction while holding this position. He has over 20 years of experience in education.

Judge II was Mr. Robert C. Rankin of Pennsylvania. He is the Director of the Driver Education and Traffic Safety Department at the Waynesboro Area Service High School, Waynesboro, Pennsylvania. Mr. Rankin holds a Bachelor of Science and a Master of Arts Degree. He, in addition to being an outstanding high school driver education teacher and administrator, is a driver education leader in the State of Pennsylvania. Mr. Rankin, further, has had traffic safety experience with a nationally recognized agency. He has 20 years of experience in traffic safety.

Judge III was J. Stannard Baker of Illinois. He is Director of Research and Development at the Northwestern University Traffic Institute at Northwestern University, Evanston, Illinois. Mr. Baker, is recognized as an outstanding accident researcher. He has written many articles in accident research. Recently he has published several articles on single-vehicle accidents. Mr. Baker has several years of experience in highway safety. He is respected for his contributions by persons in all areas of traffic safety, and has a national reputation in highway safety.

The judges received a personalized explanatory letter of the proposed study and were asked to review the project. Following their consent to evaluate the curricular models contained in part one, the models and a second letter detailing the task was sent to the judges. The judges received the six sub-components contained in part one abstracted from section three of Chapter III. The judge's task was to review, evaluate, and make suggestions and recommendations relative to the value of the approach to curriculum development and the value of the curricular models. Three specific questions were provided to guide the judges' review of the curricular models. The questions accompanied the curricular material which was sent to the judges. The questions were: (1) Does the material reflect

what a beginning motorist should know or should be able to perform? (2) Is this approach to curriculum development appropriate for driver education? (3) What suggestions or recommendations do you have for improving the project? The burden of the judges' task was to place limitations and constraints on the product, part two course of study, which was developed from the curricular models of part one. The judges' evaluation of the models was reported in Chapter IV as part of the findings.

The Curricular Models

Presented in this section are the objectives, subtasks, general driving abilities, influences of psychological factors, highway transportation system support systems, and a curricular structure.

The Objective of the Highway Transportation System and Traffic Education

The investigation of any problem in the highwas transportation system indicates that problems in traffic safety are not the kind in which a conclusive solution is easily reached. However, this is not to indicate that problems are not investigated in the highway transportation system. The traffic safety field is problem oriented rather than discipline oriented. The organizational focus of traffic safety is on the problems the highway transportation system presents to society and means of making the system better for society. The traffic safety field is further relatively uncultivated and has neither a clearly discernible or widely accepted structure in which to focus research efforts.[162]

In many respects the concerns with the discipline and structure of traffic safety are directly associated with the objective or purpose of the highway transportation system. The objective of the highway transportation system is broadly stated as the safe, efficient, and convenient movement of people and goods from one location to another. Hence, the key components are safe, efficient, and convenient. Ideally all support and managerial subsystems of the highway transportation system, including education, should be striving to accomplish the stated objective of the system. An immediate difficulty, however, is apparent when one attempts to determine the meaning or gain agreement on what is safe, efficient, and convenient. Further, it appears that the educator needs to translate the key components of the highway transportation system objective into educational objectives and communicate these derived objectives to beginning drivers. It further appears that the task of communicating highway safety objectives to individual road users has been somewhat unsuccessful.

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[162] ________. The Environment and Man, Research Through 1966 (Hartford, Connecticut: The Travelers Research Center, Inc., January, 1967), p. 41.

The traffic educator should also realize that he is part of two systems--a transportation system and an educational system. The educator, then, should support both systems within the objective of the highway transportation system and within objectives designed for the education of youth.

The current definition and purpose of driver education emphasizes both systems. In a publication by the Automotive Safety Foundation, Highway Safety Program Management, the definition of driver education expressed by the NEA was employed. Driver Education was defined as: "Learning experiences provided by the school for the purpose of helping students to become good traffic citizens and to use motor vehicles safely and efficiently."[163] (underlining added.) The concept, traffic citizenship, appeared to focus more on the education side while safe and efficient was associated with the objective of the highway transportation system. In actuality the accomplishing of either component could aid in accomplishment of the other.

The purpose of driver education as promulgated by the National Highway Safety Bureau was as follows:

> Driver education seeks to develop safe and efficient drivers who understand the essential facets of evolving traffic safety

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[163] ________. Highway Safety Program Management (Washington, D. C., Automotive Safety Foundation, August, 1968), p. 54.

> programs and who participate in the traffic environment in a manner that enhances the effectiveness of such programs.[164] (underlining added.)

The division between the systems in the Bureau's purpose of driver education was less acute than the NEA's definition because the participation was directed toward the enhancement of traffic safety programs.

It becomes apparent that regardless of the accepted definition and purpose of driver education, i.e., safe, efficient, traffic citizenship, that driver education is not the only element of the highway transportation system or society that is seeking this purpose. The attainment or failure to obtain a safe, efficient, and convenient highway transportation system is a direct measure of the highway transportation system, but, not the only measure of driver education.

For the purposes of further development in this project the objective of traffic education is as follows:

To prepare the learner to perform the sub-tasks required in driving in a competent manner and to enter the highway transportation system with potential for growth as a competent and responsible person in both operator and non-operator roles.

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[164] ________. Highway Safety Program Manual, Transmittal 11 (Washington, D. C., National Highway Bureau, Federal Highway Administration, January 17, 1969), p. 1.

Sub-Tasks of the Automobile Operator

In this section the major sub-tasks required in automobile driving are identified. The sub-tasks are derived from the operator-automobile-environmental sub-system of the highway transportation system. It is proposed that these sub-tasks be included in both classroom and laboratory instruction for beginning motorists.

The operator-automobile-environment sub-system from a human engineering perspective was characterized as a closed system.[165] In a closed loop system such as the current sub-system, a continuous performance of an ongoing process was required for control. Automobile driving was further described as a semi-automatic system because certain functions were performed by a machine component (sub-system) under human direction and control.

The task description of the operator-automobile-sub-system in this project was heuristic in nature rather than scientific in nature.[166] The task description was heuristic because no intention was made to be rigorous and restrictive in the description. However, major tasks were sequenced in an attempt to provide combinations and classifications of lesser tasks. Secondly, a vertical and lateral transfer of operator sub-tasks was part of this heuristic description. The apparent benefit in the

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[165] Ernest J. McCormick, Human Factors Engineering (New York: McGraw-Hill Book Company, 1964), p. 12.

[166] Robert N. Gagne, Psychological . . ., op. cit.

application of the heuristic approach to task descriptions in this sub-system was that the approach aids in curriculum development, and the establishment of a teaching sequence. "Task descriptions . . . provide the substance for the content of training; in addition, they may suggest the form and sequencing of training. They reference the operations to be used in evaluating both the training and the trainee."[167]

In this project the task descriptions of the operator-automobile-environment sub-system focused on what the operator had to do in operating a motor vehicle. Further the descriptions were made with cognizance of the contribution the sub-tasks made to the system. The safe and efficient movement of traffic resulting from correct performance of the various sub-tasks could assist in attaining the highway transportation system objective.

The primary purpose for the sub-task descriptions was to aid traffic educators in selecting and defining procedures for teaching the sub-tasks to beginning drivers in a skill hierarchal sequence in which prerequisite skills in task performance are met before the introduction of new sub-tasks. The task descriptions further should assist teachers in determining the mode for teaching relative to whether a sub-task is routine in nature or problem solving oriented. The identified tasks are presented in two models.

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[167] Ibid., p. 190.

Model A reflects those tasks which are discrete and routine in nature and should be habitualized by the operator. These tasks include: pre-operational, pre-start, start and secure tasks, etc. The tasks are developed in a teaching learning sequence with sub-tasks sequenced in such a manner that the first identified task is a prerequisite for subsequent tasks. Hence, the last routine sub-task requires prerequisite skills from all previous tasks. The skilled performance of basic sub-tasks in Model A further are prerequisite skills for successful performance of the sub-tasks indicated in Model B. (Model A, Figure 8, page 95.) Model A also contains two ongoing sub-tasks as part of the driving model. Monitoring of displays covers stimuli within the vehicle. Monitoring the environment includes all pertinent traffic controls, road users, and highway events. The manipulation of controls should be applied to the sequential sub-tasks in a skilled and timed manner.

Model B contains those tasks which are problem solving oriented. Model B includes the operator-sub-tasks of selecting routes, maintaining vehicles within routes, and selecting hazard-free paths, etc.

The tasks in Model B encompass specific procedures and processes which are routine and time sequenced. However, the routineness should only be emphasized by the instructor for initial learning of the sub-task because the conditions

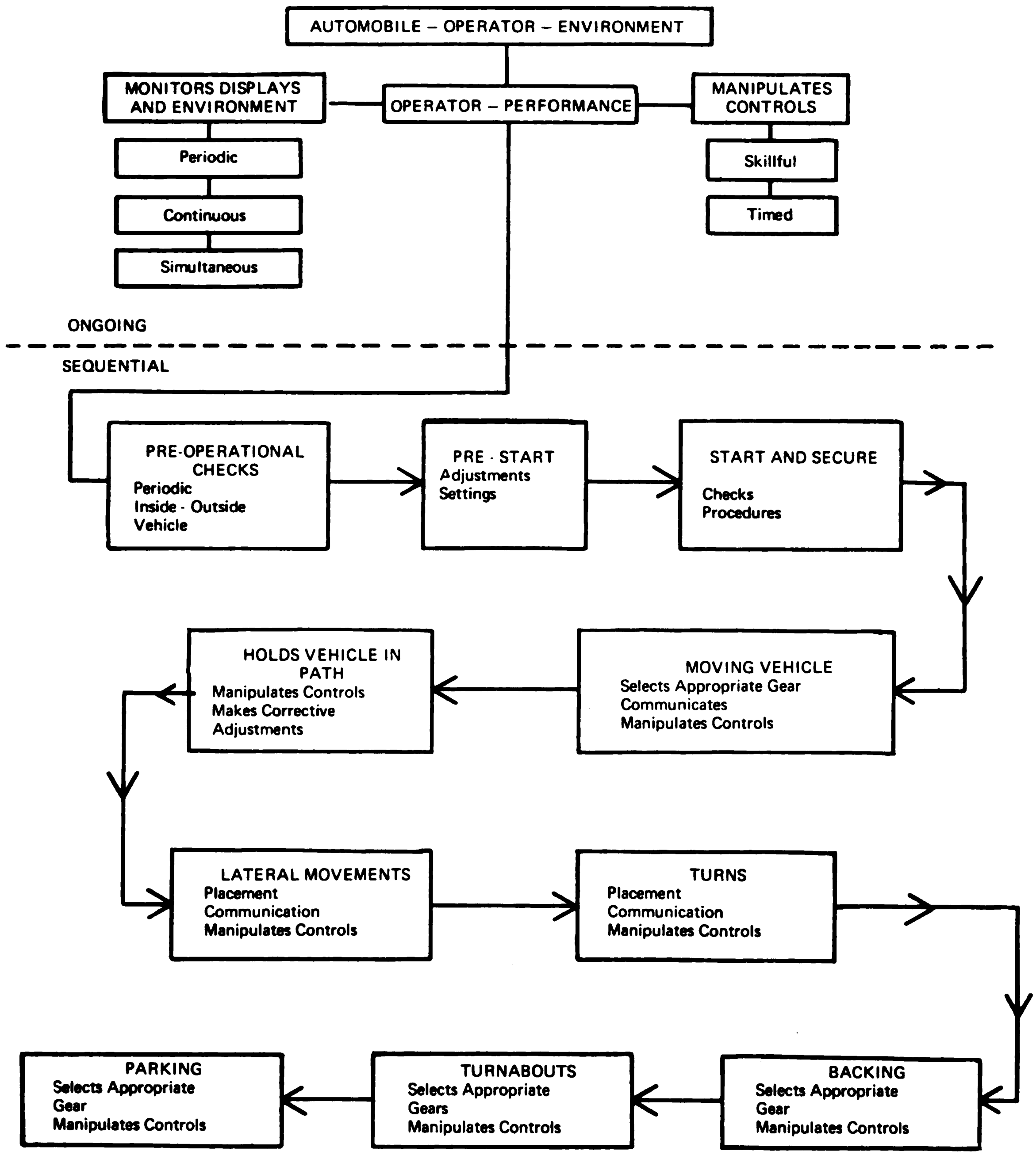

Figure 8.--Description of the sub-task for traffic education instruction of a routine or procedural nature, model A.

and contingencies within the vehicle and environment are continuously changing which requires a problem-solving mode. (Model B, Figure 9, page 97.) These tasks require operator monitoring, guidance, communication, and control based on a continuously changing visual display. Monitoring of vehicle systems and feedback of performance is also required. Rules and regulations are available in terms of laws, and there is some degree of supervision of these rules.

Some inventive behavior is required of the operator on the basis of the continuously changing visual display. However, the operator is limited in his responses to changing directions or changing speeds. These changes are accomplished by a perceptual-motor response with one or a combination of the three vehicle controls--brake, steering wheel, and accelerator.

The final major sub-task in Model B, "maintains control when confronted with contingencies and conditions," is illustrated by only a small sample of possible situations. Near failure situations can result from an unlimited number of driver errors, conditions, and contingencies. A partial list of these errors, conditions, and contingencies are included in Figure 10, page 98. Traffic education teachers should provide students with driving experiences related to these conditons and contingencies. However, the curriculum should not be based on errors, conditions, and contingencies.

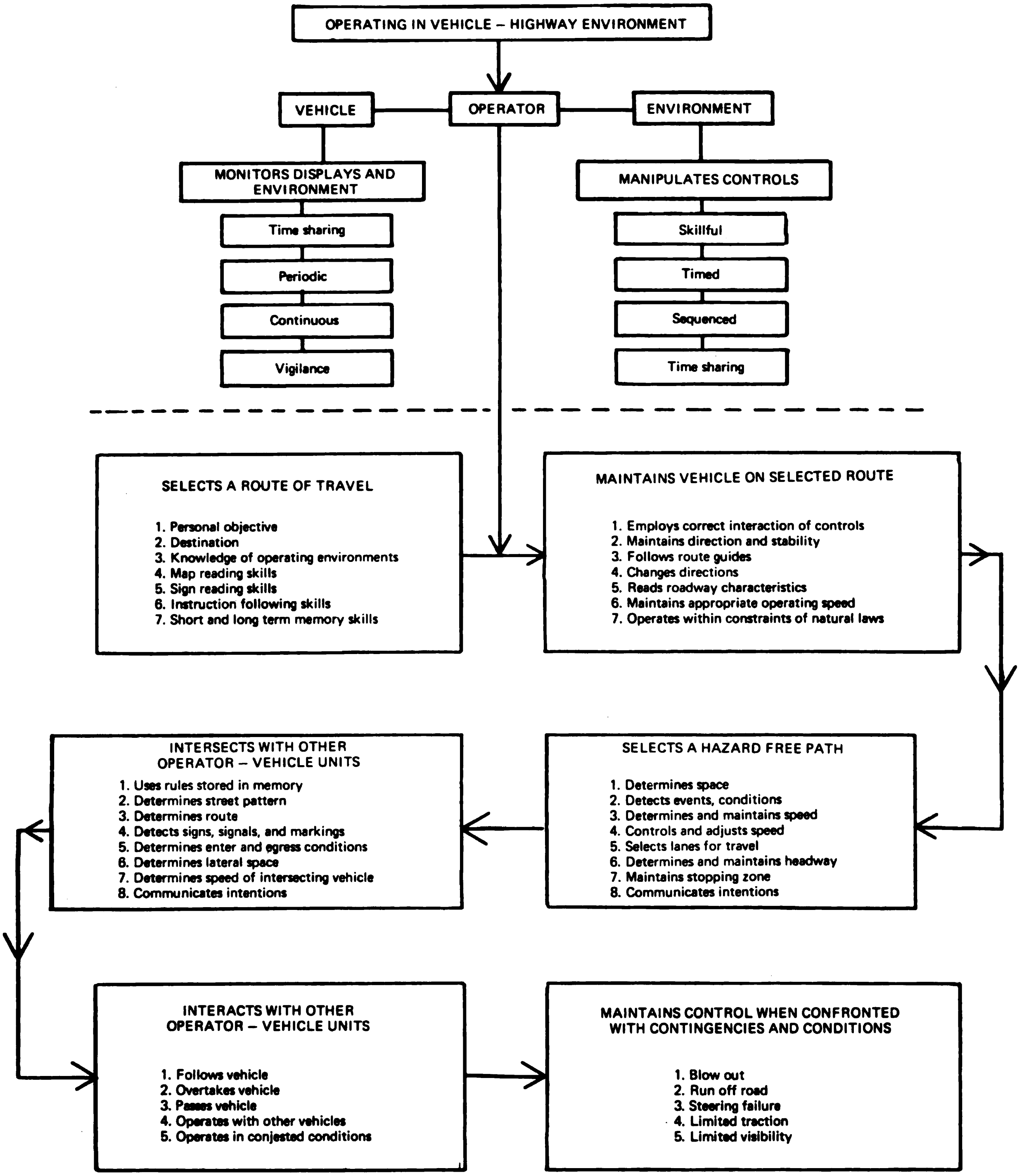

Figure 9.--Description of the sub-task for traffic education instruction within a problem solving mode, model B.

Operator Errors or Possible Failures	Vehicle Conditions	Environment Contengencies	Combination Failures
Physical Condition	Steering Malfunctions	Kinds of Surface	Panic Stop
Mental Condition	Sensory Obstructions	Signing and Marking	Stalling
Alcohol	Brake Malfunction	Number of Lanes	Skidding (Power and Direction)
Fatigue	Acceleration Malfunction	Intersections	Run off Road
Emotions	Accelerator Sticks	Kinds of Intersections	Forced off Road
Anxiety	Tire Failures	Extremes in Illumination	Hydroplane
Personality	Hood Flies Up	Straight Roads	Wrong Way Driver
Vision and Sensory Capability	Passing Gear Failure	Curved Roads	Speed
Drugs	Alignment	Narrow Roadway	Speed Variation
Behavior: Agressive, Withdrawn, Acting-out	Cornering	Visual Obstruction	Over-Under Steering
Knowledge: Attitudes, Values	Yaw	Rain	Glare
Distractions, Comfort	Engine Malfunction	Snow	False Signals
Passengers	Light Failure	Fog	Tailgating
Illness, Medicine	Vehicle Combinations	Ice	Weaving
Psychological Conditions	Vehicle Stalls	Rough Surface	Occupy Same Space

Figure 10.--Variables that can affect overall performance of sub-system.

The sub-task descriptions in Model B are composed of sub-sub tasks which are prerequisite to successful performance. The sub-task performance by an operator depends on the application of previously acquired skill, knowledge, and inventive behavior. Many sub-task components overlap, i.e., communication, which results in difficulty in time sequencing of the driver's sub-tasks. Consequently the sub-tasks are only partially time sequenced. Within Model B, however, traffic educators should be able to develop lessons for beginning operators which are task oriented, i.e., selecting a hazard free path within a route in a city driving environment.

Tasks included in Model B are also difficult to define and describe. Hence two assumptions were made. First, traffic education teachers currently have defined procedures for accomplishing the sub-tasks and components of the tasks. These procedures may be individualized by the teacher, but each teacher is consistent in his presentation of procedures. The value of the model, then, would provide for better sequencing of lessons and would focus individual teaching procedures on sub-tasks to be mastered. The second assumption was that research is needed and is forthcoming which will experimentally sequence and define procedures and components which constitute many of the sub-tasks included in this project. In the interim traffic education teachers have the responsibility to define and analyze the driver sub-tasks for their students and determine if the student has the knowledge and competencies to perform the sub-tasks.

The identified sub-tasks proceeding from Model A to Model B provide the basic laboratory teaching sequence spiral, the foundation for which may be established in the classroom.

Two similar tasks are included in both Models A and B. The monitoring of the environment and operating of controls are required of an operator in both routine and problem solving tasks. These two tasks are periodic and continuous in nature, and can be categorized as time sharing tasks.[168] It further appears that the monitoring task can best be achieved when the operator employs a systematic method of searching and scanning. However, there may be difficulty in developing performance skills and monitoring skills simultaneously with a beginning driver. Consequently monitoring instruction should not be stressed by the teacher until skilled performance of the routine sub-tasks are demonstrated. This prerequisite division should facilitate the learning of skilled performance of routine sub-tasks, monitoring functions, and problem solving tasks.

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[168]B. W. Stephens and R. M. Michaels, "Time Sharing Between Compensatory Tracking and Search and Recognition Tasks," Highway Research Board Record 55 (1964).

General Abilities Required of An Automobile Operator

The previous section on sub-task descriptions indicated some of the major tasks that are required of an automobile operator. However, the abilities required of an operator to accomplish these tasks in the operator-vehicle-environment sub-system were not included in the description. In this section a description and model of the general abilities logically required of a beginning automobile operator in driving situations regardless of the driving sub-task is presented.

The driving abilities required for an automobile operator are presented in an input-output model. Further, the description and discussion is restricted to the general abilities within the input-output model. Frequently the general abilities are referred to as human functions or functions.[169] These functions can be general in the sense that they are common to man or may be specific in the sense that they are required in a given task. The importance of general abilities or functions are evident in view of the prime objective of the highway transportation system: the safe, efficient, and convenient movement of

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[169]Harold E. Bamford, "Human Factors in Man-Machine Systems, Human Factors, 1 (November, 1959), pp. 55-57.

people and goods is predicated upon the abilities of the human being who uses the system.[170]

Using the information derived from the sub-task descriptions, defined as tasks to be performed by the operator, it was possible to design a model of general operator abilities required in automobile driving. The model of general operator abilities is presented in an input-output box. The oval shapes of input and output link the operator to his environment through physical stimuli and vehicle response. The triangular symbols of sensing and performance represent the operator's initial and terminal response in driving situations. In this phase the operator is dealing with the physical components of the vehicle-roadway system. The rectangular symbols represent the required general abilities or functions of an operator. These symbols depict the operator cognitive components of driving. (Model C, Figure 11, page 103.)

The general abilities or functions model was designed for curriculum development and provided for a philosophical orientation to the teaching-learning process. The orientation included the mental aspects of driving as well as the physical aspects. From Model C it is apparent that driving depends on stored information and mental processing in a dynamic situation. Physical skills are important to

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[170] Lee W. Cozan, "Engineering Psychology and the Highway Transportation System," American Psychologist, 16 (1961), p. 263.

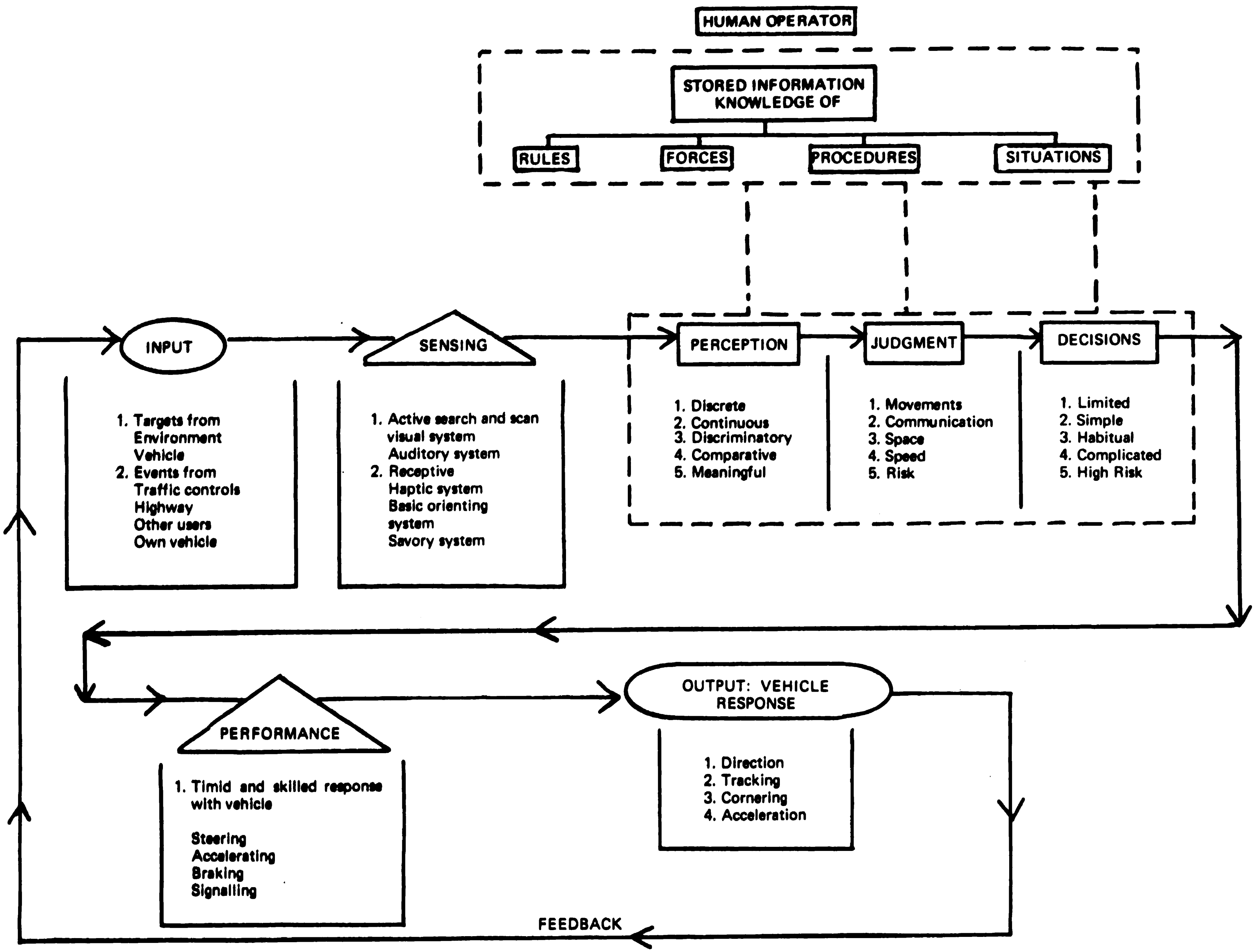

Figure 11.--Operator-vehicle-highway sub-system model, model C.

automobile driving but are easily mastered and invariant.[171] Although a physical and mental classification of driving abilities is indicated, a second dimension of this orientation is apparent. Training in physical skills of vehicle operation and the attainment of a functional efficiency level is a prerequisite requirement for instruction in mental processing. The training in physical skills parallels the mastery of the routine sub-tasks in Model A, whereas mental processing largely parallels the problem solving sub-tasks in Model B.

Interaction of Human Functions

The various segments of mental processing (perception, judgment, decision-making) are difficult to distinguish when they occur together in the same driving situation. The abilities or functions can not be observed directly but can be inferred from total performance. There is also a close relationship between sensing and perception, perception and judgment, and judgment and decision-making. Some perceptual theorists consider sensing and perception as separate processes, while others indicate that we are definitely moving away from the two process idea.[172, 173] Perception and judgment are sometimes used

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[171] J. J. Gibson and L. E. Crooks, op. cit., p. 453.

[172] James J. Gibson, The Senses Considered as Perceptual Systems (Boston: Houghton Mifflin Company, 1966).

[173] S. Howard Bartley, Principles of Perception (New York: Harper and Row Publishers, 1958).

inter-changeably although this appears to be erroneous, because judgment may include several perceptions and certain concepts and memories.[174, 175] A measurable distinction between perception and judgment would depend on the criteria variable and previous experimental definitions. Judgment is sometimes employed to include both judgmental and decision-making properties resulting in the identification of only one human function. When this synthesis is made judgment is defined as the final function before performance and is described in response terms.[176, 177]

There is a definite interrelation in terms of the interaction and overlapping among the general abilities required in driving. Also in certain driving situations, there is filtering in which only part of the available information is used and shunting in which some functions are by-passed. Filtering and shunting can be both an asset or a limitation in driving depending on teacher instructions and specific driving sub-tasks. (Figure 12, page 106.)

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[174] Ibid.

[175] Lawrence Schlesinger, op. cit.

[176] Ward Edwards, op. cit.

[177] T. W. Forbes, "Traffic . . .," op. cit.

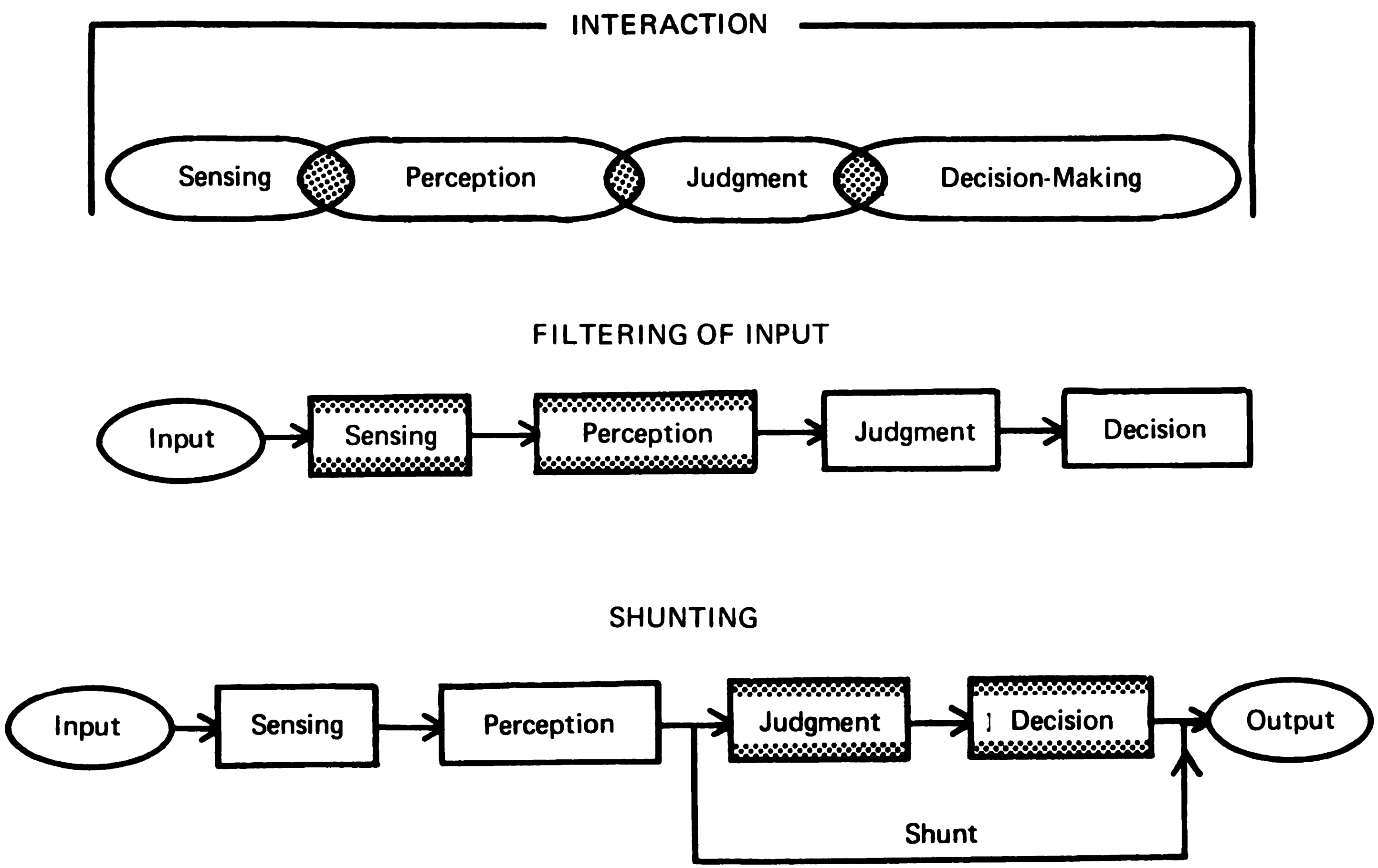

Figure 12.--Interrelation of functions.[180]

[180] Gagne, Psychological. . ., op. cit., p. 39,54.

In this project the mental processes were classified on the premise that they identified general abilities required in all driving sub-tasks, and could be categorized into instructional divisions.

Because the human being is extremely complex and variable it is impossible to describe driver functions except in general terms. However, until more specific research on the required automobile operator abilities is available the major functions indicated in this project are being suggested as part of the traffic education curriculum.

Input as Information for the Operator

Input of events for the operator to cope with originate within the vehicle or total driving environment. Platt[178, 179] has attempted to identify and classify the events in his research. He identified an extensive list of continuous, discrete, stationary, and dynamic events which were derived from both the vehicle and environment. He further classified the input into highway events, traffic events, unrelated events and total events. These events, according to Platt, were the events that required driver observations.

The operator certainly needs to define a classification of events to prevent the overtaxing of his perceptual

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[178] Fletcher Platt, "A Unique . . .," op. cit.

[179] Fletcher Platt, "Operation . . .," op. cit.

abilities. In the schematic Model C of general driving abilities, the event classifications were traffic controls, highway, other users, and own vehicle. This event classification (Figure 13, page 109) was devised to aid teachers in selecting learning experiences and driving routes. The beginning automobile operator can not cope with the entire array of events within most driving situations. Consequently, teachers should sequence driving lessons in a systematic manner in order to allow beginning motorists to increase their competencies in sensing, perceiving, and judging events throughout the entire driver education program.

The introduction of the input classification also parallels the previous identified sub-tasks to a substantial degree. For example, when pre-operational checks, pre-start, and starting sub-tasks, are being mastered, the driver is pre-occupied with his own vehicle. Hence in this learning experience, the basic foundation for receiving input from the classification of "own vehicle" should be established. The suggested order for developing beginner's competencies in input sensing and perceiving is "own vehicle, highway, traffic controls, and other users." This sequence should further aid teachers in selecting routes or learning environments for the beginner. At the time most habitual sub-tasks are being mastered by the beginner the events of "own vehicle" and "highway" should be stressed. In problem-solving sub-task situations the number of

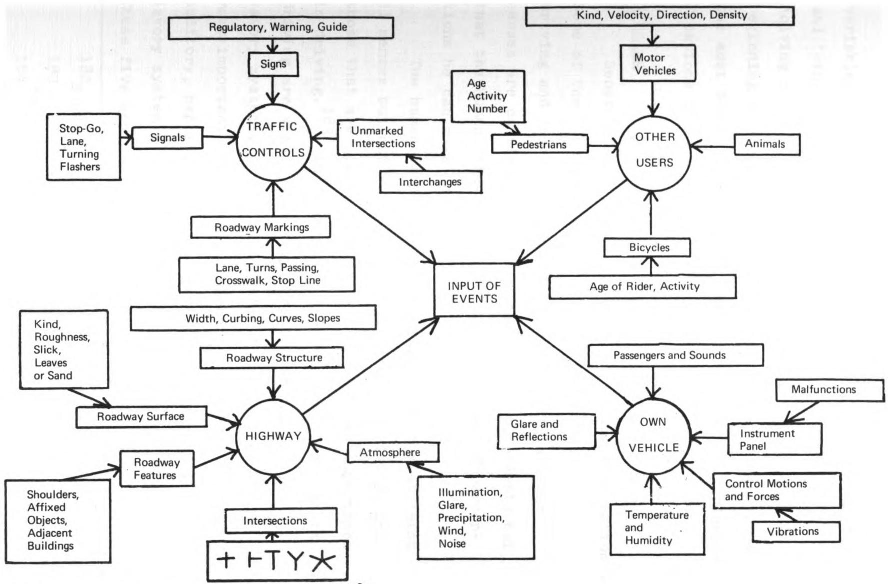

Figure 13.--Input: Target, events.[181]

[181]Gerald Streeter, op. cit.

variables are usually increased. Thus "traffic controls" and "other users" should be emphasized in the problem-solving tasks. With a systematic approach to input the beginning driver should develop competencies to cope with the most pertinent events and events from all four classifications in most driving situations.

Sensing

Sensing is defined as the process of input reception. Some of the input is further processed and utilized in driving and some is disregarded. It appears that the senses are continually receiving stimuli impingements but that the human being is limited in the number of perceptions he can make per time unit.[182]

The human being receives impingements from at least 11 senses but not all have significance for driving, and those that are significant are not of the same importance in driving.[183] In Model C, the sense modelities used in driving are visual, auditory, haptic, orienting, and savory systems. The visual system is recognized as the most important input reception channel for driving. The auditory, haptic, and orienting are important and the savory system is important in emergency situations.[184] These five sensory systems can be viewed as channels in

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[182] Fletcher Platt, "Operations . . .," _op. cit._, p. 20.

[183] _Ibid._

[184] _Ibid._, p. 20.

which input travels but is not yet processed into meaningful information for driving.

Some systems perform a sensory inquiry into the environment when the operator searches and scans. In driving the operator's visual and auditory systems can search and scan. These are his active senses which provide primarily for a space extension of the operator into his field of travel and receive various kinds of roadway information and information concerning vehicle malfunctions. The other systems are more passive or are receptive of information.

The division between active and receptive systems of sensing input provides for a needed distinction between training and experience required in driving. The traffic educator should provide training in a systematic method of actively searching and scanning the driving environment.

A system of seeing was developed which appeared logical and was founded on sound principles for seeing. The system was field tested with experienced motor vehicle operators.[185, 186]

Presently there is neither a system for auditory sensing nor a system for visual sensing for beginning drivers. Within the limits of this project, it is suggested that the scanning and searching activities be

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[185] H. L. Smith and J. J. Cummings, op. cit.

[186] Donald Payne and J. E. Barmack, op. cit.

systematically implemented on the basis of the four input categories and parallel the previously identified sub-tasks.

The receptive sensory systems do not readily lend themselves to training. In fact, frequently, the beginning motorist is not aware or fails to process the input received by these systems. The beginner further, fails to identify his less than proficient performance. This limitation could be overcome by the use of experimental driving simulators. However, this is not a practical approach for the education of large numbers of drivers. It appears that the traffic education teacher needs to structure a variety of road experiences which provide for sensory impingement of the receptive systems. Further he should provide hints and instructions in order to facilitate driver awareness of input from these senses.

Perception

Driving is guided by perception. The guidance task is primarily a visual sensory perceptual task. Sensory perception provides for the organization of dynamic input resulting from the interaction of man-vehicle and roadway. This involves both the sensing and identification of events.

Several definitions of perception were available for use by traffic educators, and two components were generally included in the definitions. First, sensory contact with an energy source was required, and an organism response to the energy source was needed. "Perception is the overall activity of the organism that immediately follows or accompanies energistic impingements upon the sense organs."[187] Secondly, "Perception may be termed the first transformation of environmental stimulation into meaningful human information. Its determinants are complex depending in part on what has immediately preceded, on expectations, and immediate as well as long-term needs."[188]

It is apparent that an educator must be concerned with two elements of the perceptual processes. The first element focuses on perceptual training. This may be considered as providing input energies for the organism to respond to or transform. This first element is of primary concern in this section.

The second element deals more with the determinants of perception which influence the organism in any behavior or activity. These determinants encompass the frequently labeled psychological concepts of perception. They go beyond training or driving and are reflected in all human behavior. These determinants are prerequisite for a receptive learner and influence the quality and quantity of learning. To a large extent the determinants of perception are present in all teaching-learning situations, and influence how the teacher or learner perceives himself or the

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[187] S. Howard Bartley, op. cit., p. 22.

[188] R. M. Michaels, op. cit., p. 593.

task involved. An understanding of perception from this point of view sets the climate for how the student and teacher react to each other. The perceptions can be fear oriented or can include mutual trust and respect. The determinants can be classified as part of the study of social perception.[189]

In perceptual training, both for laboratory and classroom, the beginning motorist has to ask himself: where and what should I look for? what is each event and what can it do? what should I make of it? what is the event actually doing? and what is the relationship and interaction between various events? In order to answer these questions the motorists must receive sensory data, maintain awareness, and select relevant cues and events for organization and interpretation.

The operator selects relevant cues and events from both the vehicular and environmental displays. Hence the operator's perceptual task can be divided into a display monitoring task and an environmental searching and scanning task. The ultimate objective of the perceptual task is to select a safe field of travel from the possible fields.

The monitoring, searching, and scanning task can be categorized as a time-sharing task in which the operator must divide his perceptual time to an optimum degree.

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[189] S. Howard Bartley, op. cit.

These two perceptual tasks interact and can interfere with performance when the perceptual tasks compete for the operator's time.[190] The monitoring task of the operator is usually defined as a discrete perceptual task. The searching and scanning task is ongoing and is defined as a continuous task. In both tasks man has limitations which can be compensated for by task oriented training experiences.[191]

Perceptual training for beginning motorists should be conducted in a systematic manner in order for the operator to determine the optimum time-sharing relationship for various environments and driving situations. Even though the training has to be systematic the actual operator's perceptual performance should be flexible since he has to select task relevant cues. A prerequisite for perceptual independence of the operator depends on the mastery of motor skills necessary for performing the various sub-tasks identified in Model A.

> Where flexibility of behavior in the performance of procedures is desired, one or more of the following conditions should be met. The operator should have 'automatized' many of the stimulus-response relationships. He should also have had sufficient practice so that he is at least fairly adept at handling the short-term recall requirements during task performance. The task situation should permit him some degree of anticipation of

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[190] B. W. Stephens and R. M. Michaels, op. cit.

[191] Albert E. Hickey and Wesley C. Blair, "Man as a Monitor," Human Factors, 1 (September, 1958), pp. 83-84.

> the next stimulus in the action series, so that he is not stimulus-response bound in time.[192]

The actual perceptual independence of the operator is developed during instruction on problem-solving sub-tasks identified in Model B.

The monitoring training task should be based on the input of "own vehicle" included in Figure 13, and be taught in conjunction with the sub-tasks in Model A. The searching and scanning task is dependent upon input classes of "highway, traffic controls, and other users" and should be developed as an integral part of the problem solving sub-tasks in Model B.

The trained observer does not necessarily sense or perceive better than the untrained but apparently attends to relevant task cues more effectively. The attending of task relevant cues seems to improve as familiarity with the events is increased by either practice in observing or recalling pertinent events. Motorist's perceptions may be further facilitated by an observation routine.[193]

The perceptual training in event detection and recognition should be accomplished in task-simulated situations or through actual practice. Hence perceptual training can be accomplished in part through both classroom and laboratory traffic education experiences. The

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[192] Robert M. Gagne, Psychological . . ., op. cit., p. 221.

[193] Ibid., pp. 46, 219.

operational routine for perceptual training should focus on the input classification. The beginning motorists should be provided with repetitive and systematic experiences which facilitate the development of perceptual ability needed for automobile operation. The sequencing of perceptual training based on the input categories should provide for both familiarity and the establishment of an observational routine.

Each input classification (Figure 13) contains several events which influence the operator's performance. The instructor should provide for visual observation of these events individually until the beginning motorists can define the class. When all classes are defined the observer should be visually exposed to mixed classes of events until he can identify the most relevant cues in either simulated or actual task situations. The primary training concept which guides the traffic education instructor in perceptual training is to systematically increase the number of events within a class of class mix while decreasing the amount of observational time allotted to the potential motorists.[194]

When perceptual training takes place on street the teacher needs to select practice routes on the basis of

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[194] ________. School and College Safety, National Safety Congress Transactions, Vol. 23 (Chicago: National Safety Council, 1968).

input classes and cue student operators to events within the defined classes.

The instructor should further have an understanding of several principles of perception which can facilitate perceptual development for motorists. First, perception by the operator takes time. Perceiving driving input is a process which involves the mind and senses. The organism must receive, select, and organize the driving events. The time required for perception can be lessened by training and experiences.[195, 196] However, there is probably an upper limit of the number of events that can be perceived by an operator. When this limit is reached, the operator's perceptual ability becomes overtaxed.

Perception is a selective process. Since the automobile operator can not perceive all events in a driving scene he must be selective. Those events that are selected will depend on past experiences. The traffic educator can control the experiences through perceptual training, hints, and instructions related to crucial driving events.[197, 198]

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[195] Warren Quensel, "Teaching Visual Perception in Driver Education," ADEA News and Views, 3, 2 (May, 1963), pp. 3-12.

[196] Crow and Crow, An Outline of General Psychology (Paterson, New Jersey: Littlefield, Adams and Company, 1961).

[197] Warren P. Quensel, "Teaching . . .," op. cit.

[198] Samuel Komorita, et al., Review Outline of Psychology (Paterson, New Jersey: Littlefield, Adams and Company, 1962).

A mental or perceptual set can be established by the operator on the basis of instruction or training. In essence the beginning operator can be taught to perceive certain events, and in all probability will perceive these events first when confronted with a driving situation.[199, 200, 201] This set can be established as part of short or long term memory and can be established in relation to specific driving sub-tasks or the general operating environment. The operator is actually taught to search for relevant cues while filtering non-relevant cues.

Lastly, the operator will tend to perceive those events that are logically grouped or that interact collectively. The operator will require less time to perceive those inputs that are related or classified. The classifying of events by an experienced observer may appear natural, but the perception can be facilitated by repetitive observation of grouped events. The classification of input in Figure 13 is based on the grouping principle.[202]

These various principles should determine the focus of the training and the nature of the training media.

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[199] Warren P. Quensel, "Teaching . . .," op. cit.

[200] Crow and Crow, op. cit.

[201] Robert M. Gagne, Psychological . . ., op. cit.

[202] Warren P. Quensel, "Teaching . . .," op. cit.

Judgment

Judgment is the second link in the mental processing task required of the motor vehicle operator. Judgment may be defined as a process of categorizing input in terms of effects rather than in terms of appearances. Thus judging is identifying the meaning of inputs in terms of expected results.[203] The process involves the ability to size up the situation, make comparisons, make estimations, and make assumptions and appraisals.

If the operator asks himself the following questions, he is employing his judgmental ability: what will it do and how much? what is the degree of quality of event or object? is it a threat or can it become one?[204]

Judgments further, depend on alternatives. When a person is required to make a choice beyond habitual responses judgment is involved. Hence judgment appears to be of particular importance in problem solving operator sub-tasks.

Judgmental ability actually goes beyond the immediate situation. Judgment brings into context, information that is relevant to the task. The information that most frequently assists the motor vehicle operator in judgment

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[203]Robert M. Gagne, Psychological . . ., op. cit., pp. 49-53.

[204]________. The Introduction, Rationale, and Basic Outline for the Revised Program of Instruction (Office of the Superintendent of Public Instruction, State of Illinois, April 25, 1969), p. 33.

making consists of rules or laws, human characteristics, vehicle characteristics, and physical forces.[205]

Motor vehicle law serves as a basis for making judgments about other operator-vehicle units in the sense that law establishes what is required and permitted. By establishing what is prohibited, required, and permitted, laws provide a basis for judging or determining the likelihood of conflict free space for manipulating the vehicle. This common basis (law) for making judgments will continue to be important information to the driver as long as the driver must operate in close proximity with other vehicles of different sizes and speed capability on a wide variety of unfamiliar streets and highways. The closer the highway user conforms to the rules and regulations, the greater the probability of accurate judgments.

Information concerning human characteristics can provide relevant assistance in making driving judgments. There are general behavioral tendencies which can assist in judging. For example, impatience, anxiety, and the like can be induced in certain driving situations. Likewise there are specific characteristics which can be recalled in context that provide a foundation for making driving judgments. Some of the human characteristics are age, sex, personality, physical conditions, and experience.[206]

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[205]Lawrence Schlesinger, "Objectives . . .," op. cit.

[206]William Lybrand et al., op. cit., p. 117.

In addition to the human characteristics, the immediate behavior of other operators can provide information for judging further operator unit interaction.

Stored information concerning vehicle characteristics can aid in judgment making. Information on vehicle characteristics is especially important in terms of timing, determining gaps, and determining space. In order to achieve proper timing, select gaps and conflict free space, the operator must judge the performance capabilities of his own vehicle and other users. He must also be able to judge the probable traffic patterns due to a mix of road users and possible consequences resulting from this mix. Specifically the operator should have stored information to assist in making proper judgments, concerning the acceleration, braking, steering, cornering, and stability parameters of all motor vehicles using the highway transportation system.[207]

The final informational storage source is physical forces. The understanding of natural laws determine from a judgmental perspective the limits of the vehicle-environment interaction. From the operator's point of view he must judge or interpret the constraints imposed by the environment. Further he must determine and make proper time-space judgments to remain within the parameters of the conditions imposed by highway design.

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[207] Ibid., p. 62.

The operator makes three special kinds of judgments within the context of his environment and driving situation. He makes lateral, longitudinal, and angular judgments. All three judgments are directly related to the operator sub-tasks identified in Models A and B. For example, in passing a vehicle all three kinds of judgments are required. Some form of judgment is employed in all driving situations. But beyond the judgments which provide for space and time to perform sub-tasks, the operator has another critical task of judging hazards. The ability to judge the probability of other operators creating hazardous situations is a difficult task. The operator must command a variety of stored information plus have accurate perceptions of the immediate situation. Thus judgment is based on the behavior of other operator units as reflected by the characteristics of the operators, the kinds of vehicles being operated, the existing roadway, and traffic patterns. Further for each of the hazards interpreted, it is necessary for the operator to estimate the consequences. The chance of serious conflicts or collisions must be appraised in terms of the alternatives available. In the event a collision appears unavoidable, then consideration should be given as to how to minimize the hazard.

A judgmental training program should provide the capabilities for a potential operator to manipulate the direction and speed of his vehicle in such a manner as to have space and time to perform the various sub-tasks and avoid hazardous situations. The training program should focus on driving input, sub-tasks to be performed, and relevant stored information. The potential operator should be provided with simulated and actual instruction and experiences in making driving judgments.

Decision-Making

Decision-making is defined as the cognitive formulation of a course of action with the intent to implement or execute the decision.[208] In the highway transportation system the motor vehicle operator is entrusted extensively with the responsibility of making decisions in terms of desired trips and actions within a chosen trip. In decision-making the operator must decide when, where, what, and how much action to take from known alternatives.

The decisions the operator makes are many and varied. He selects a general route to follow and a time to start in order to reach his destination. Within the selected route he decides on a series of specific pathways to guide his vehicle. These decisions can be very complex, but appear simple because the observed product of decision-making is limited. The operator can only manipulate a limited number of controls and the vehicle response is limited to speed and direction change.

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[208] Lawrence Schlesinger, "Objectives . . .," op. cit., p. 22.

Many driving situations have limited alternatives, hence, decision-making in some cases is simple. Most simple decisions probably become habitualized by the operator. This appears to be the case for the sub-tasks identified in Model A. Operator decisions should be habitualized for Model A sub-tasks, but for Model B the operator should perform in a non-habitualized manner. If simple decisions are in fact habitualized, then, the operator should be free to make complicated decisions when the need exists.

Complicated decison-making is required when time for mental processing is limited, when several alternatives are available, and when there is a need for the operator to depend on both long and short term memory of information to make his decision.

Risk is also involved in operator decision-making. Decisions have to be made in a limited time, the best alternative may not be available, and driving is performed under conditions of uncertainty.

Operator decision-making involves mental processing that leads to the selection of a response from among a known set of response alternatives. Even in the simplest decision-making task alternatives are available to the operator. This means that practice in making various types of driving decisions should be required of the beginning motorist. The practice should reflect the content of the sub-tasks of Models A and B. The training media, both simulated and actual, should focus on driving situations that depict uncertainty, unpredictability, complexity of events, limited time, and conflict among alternatives.[209]

Training and actual route selection for instruction of beginning motorists should also be based on principles of decision-making applicable to driving. These principles, which should assist both the teacher and operator, follow:

1. decision-making depends on both long term and short term memory[210]
2. decision-making is dependent upon the quantity and quality of information
3. simple and routine decisions should be habitualized, allowing time for decision-making in complicated situations
4. decision-making in unfamiliar situations is more difficult than in familiar situations and requires more time
5. the capability of the operator to make rapid decisions decreases in proportion to the number of choices and complexity of the situation.[211]

In summary, the general abilities or functions required in automobile driving were identified. These

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[209] _Ibid_.

[210] Robert M. Gagne, _Psychological . . ._, _op. cit_.

[211] ________. _The Introduction, Rationale, . . ._, _op. cit_.

functions were discussed in terms of mental processing as it related to driving and how the traffic educator could approach the teaching-learning process.

Psychological Factors and General Driving Abilities

Contained in this section is a treatment on how psychological factors influence the general abilities required of an automobile operator. This section is of special importance because the human operator does not perform skilled tasks or processes in a behavioral vacuum. He performs the task of driving within the behavioral or psychological influences attributed to man in any activity. Man is a psychological being and is vulnerable to a host of temporary and permanent psychological factors.

Psychological factors are of importance to the curriculum developer in traffic education because the factors influence the general abilities required in driving. Studies of personality and behavior should be included in the school curriculum as a separate entity, but are of significant importance to traffic educators as an applied discipline.

Figure 14, page 128, provides a schematic example of the influence of psychological factors on general driving ability. This model presents only a sample of possible factors to be included in traffic education instruction. Likewise the organization of psychological factors is

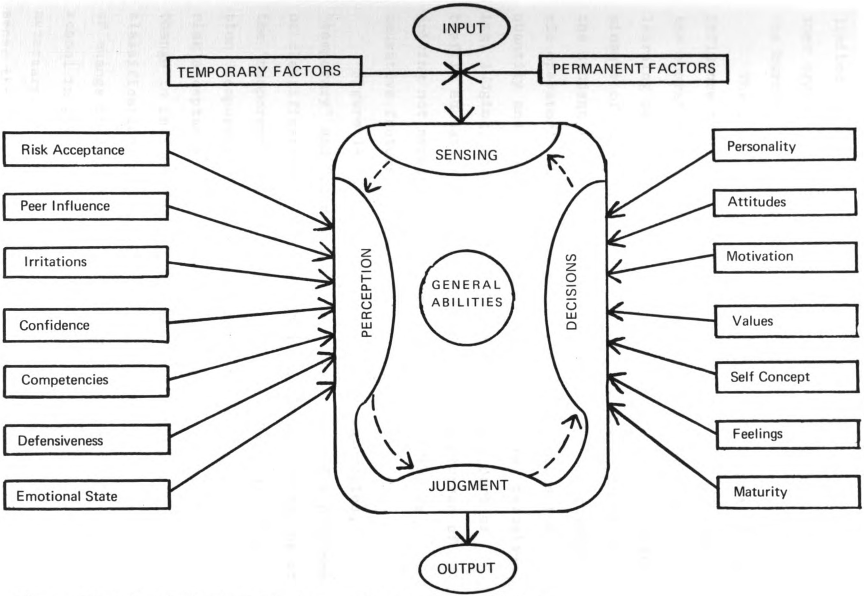

Figure 14.--Psychological factors and general abilities.

limited to the influence on general driving ability. Further organization is a matter of pedigogy which should be the burden of the individual teacher.

The psychological factors presented in Figure 14 can influence the teaching-learning process or can influence the operator's ability in driving. From a teaching-learning perspective these factors influence or are determinants of learning. They influence the degree in which the student is receptive to learning. From a motor vehicle operator's standpoint, these factors influence the quantity and quality of an individual's sensing, perceiving, judging, and deciding. These factors are part of traffic education because they influence the process of driving not merely because they can be identified as causative factors in accidents.

Figure 14 is divided into two major categories, "temporary" and "permanent." This division is for purposes of classification. There is definitely some overlapping of the "temporary" and "permanent" factors. The classification "temporary" is employed because the influence of risk acceptance, peer approval, irritations, etc., may change in influence within a single automobile trip. The classification "permanent" however, does not imply absence of change or development. The traffic educator and the school in general attempts to modify these factors when necessary. However, these factors are "permanent" in the sense that they are more enduring than those identified in the "temporary" category. In addition deliberate effort over a long period of time may be required to modify the "permanent" characteristics of an individual. In many instances change is difficult because an individual is unaware of the "permanent" factors determining his behavior.[212]

The "permanent" factors also represent a higher order concept. For example, the personality of an individual will influence the amount of risk acceptance or the degree of confidence or competiveness. The factors of risk, confidence, and competiveness may also be included as part of self-concept. The interrelation of factors further substantiates the complexity of man and tends to indicate that the better man understands himself the more likely he will perform with proficiency in tasks such as driving.

There are other factors beyond the psychological which have a similar influence on the operator's performance. The psychological factors are internal to the individual, but there are factors that are both internal and external in nature which influence motor vehicle operation. Alcohol and other drugs are external to the operator, yet, when consumed can influence the general driving abilities. Further, the consumption of drugs can result from the influence of either "temporary" or "permanent" psychological factors.

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[212]Salvatore H. Maddi, _op. cit_.

Additional internal and external factors which can influence the driving process include age, development, fatigue, carbon monoxide, illness, and physiological factors in general. From an instructional perspective, these factors as well as the psychological factors, could be included in one instructional unit.

The psychological factors which influence the general driving ability should be developed and evaluated throughout the entire traffic education program. In dealing with these concepts teaching method is of extreme importance. The teaching function should not be designed to convey information. In fact, the student need not be able to label the concepts in order to perform as an automobile driver. The teaching mode should be structured in a manner to help students discover why they behave as they do. The approach to teaching or developing an understanding of behavior should allow the student to evaluate, conduct self-analysis, and self appraisals. The teaching learning process should provide for trigger situations based on the "temporary" and "permanent" factors so the student can determine how and why he behaves the way he does. The student should be allowed to search his experiences and modify his behavior on the basis of internalized and personalized standards which will aid his driving performance.

In summary, this section contained a sample of psychological factors which influence the driving process.

These factors were suggested as part of traffic education because they influence driving not because of their association with accident causation. Also included in this section was the identification of some other influencing factors such as fatigue.

Major Support Systems Influencing Driver Behavior

The effectiveness of the highway transportation system ultimately depends on whether or not the driving task and environment place demands on the individual user which exceed his psychological and physiological capabilities.[213] However, there are numerous support agencies which function to assure individual users of a safe, efficient, and convenient highway transportation system. Frequently, the individual user is unaware of these support systems, and in some instances performs as an operator and non-operator in such a manner as to negate the efforts of the support systems. The highway user should realize that the highway transportation system can not entirely be improved by operating better, but may be improved beyond his individual efforts by better management methods.[214] The highway user should be willing to

[213] Lee W. Cozan, op. cit.

[214] R. Myrick and L. W. Schlesinger, "Driver Improvement or System Improvement?" Traffic Quarterly (January, 1964), p. 92-104.

support those sub-systems which seek to improve operator-machine, operator-roadway, and operator-other user interaction.

Within the scope of traffic education, support for the highway transportation system's managerial efforts can be approached from four points of view. First, motor vehicle operation is motivated by a desire to reach a destination or to use a vehicle for pleasure. This is why the individual drives. Consequently those support or managerial systems which assist the operator in arriving at his destination should be of special importance to the operator. For example, they are important in the sense that proper enforcement should screen, remove, or correct unsafe operators which ultimately assists the individual operator in reaching his destination. Secondly, some support-systems influence the driving process or can place limitations on the general abilities required for motor vehicle operation. The operator should support these sub-systems because through highway design, signing, and traffic flow, the sub-systems can influence driver performance. Through proper design the support systems can assist the operator in receiving and processing information pertinent to the operator's task and can prevent the immediate task from overtaxing the operator's capabilities. Third, the beginning motorists chould be motivated to learn about the highway transportation system because he is embarking on a new membership participation role. The new motorist has always been a member of the highway transportation system as a pedestrian, a cyclist, or a passenger. As a member in a new role in the highway transportation system he should be willing to learn and cooperate with those sub-systems that determine new membership and provide for continued membership in an operator capacity. Further the beginner should realize that his new participant role provides for new responsibility, both as an operator and non-operator. Lastly, support for the sub-systems goes beyond the concept of general citizenship. The new member in the highway transportation system should be motivated to support the system because of the consequences. The better the highway transportation system the greater the reward for the operator in terms of a safe and efficient system. He is not asked to be cooperative because of courteousness and citizenship, but for an improved system in which he is a member. This should be an acceptable approach with a beginning motorist provided he understands that driving is only a sub-task of the highway transportation system.

The traffic education curriculum can not include instruction for all support systems. Traffic education differs from highway transportation system education. The traffic educator has to be selective in terms of which support systems receive instructional time. Consequently, Figure 15, page 135, identifies some of the major support systems which could be included in most traffic education

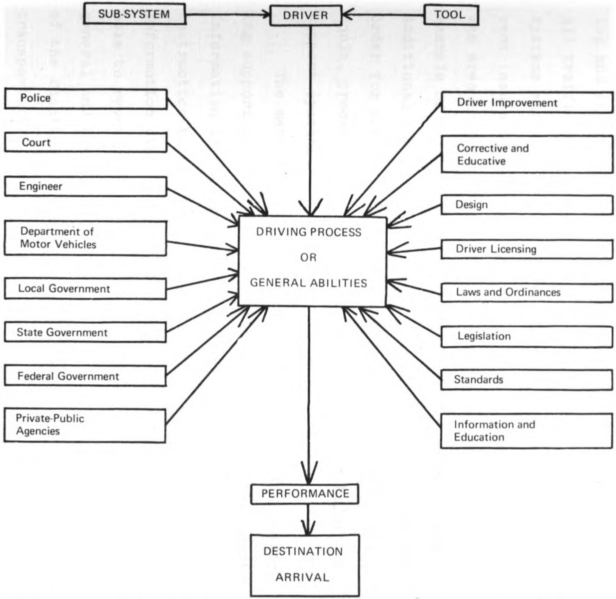

Figure 15.--Major support systems influencing driver behavior.

courses. The figure presents the sub-systems and an example of the tools these support systems may use.

These support systems contain a body of knowledge which is important for beginning motorists. The engineering and enforcement sub-systems perhaps would be part of all traffic education courses. However, the other sub-systems may well change or be expanded, depending on current issues concerning the highway transportation system. The area identified as "tool" in Figure 15 is only an example of some of the functions the sub-systems perform. Additional functions of these systems should be taught in order for the beginning motorist to understand the basic tools, procedures, and purposes of each of these major support systems.

The method employed by the traffic educator concerning support systems should be attitudinal in nature. Basic information is important to this attitudinal mode of instruction but instruction should not terminate with information dispensing. The beginning motorist should be able to reveal his current feelings of the systems in general and evaluate and re-evaluate his feelings in terms of the functions these sub-systems perform for the highway transportation system.

Curricular Model Delineating Major Instructional Units in Traffic Education

In this section the major units in traffic educaton are presented in an instructional model. This instructional effort would require both classroom and laboratory experiences. Further the accomplishing of the instructional units depends on the interaction and integration of classroom and laboratory instruction.

The instructional model was designed for the purpose of structuring a theory of traffic education into one curricular model which includes: (1) the objectives of the highway transportation system; (2) the major sub-tasks of an automobile operator; (3) general abilities required of an automobile operator; (4) psychological factors; (5) support systems; and (6) other concepts.

The instructional model should provide suggestions for high school teachers for further formulating a meaningful and quality traffic education program.

The curricular model, Figure 16, page 138, depicts the major instructional divisions and units in traffic education. The units were structured with the learner in mind. The conceptual structure of the units is designed to provide for motivation and appeal. The students are quickly given driving experiences, and should be aware that the task they are performing is only part of a highly complex system. The units are structured in

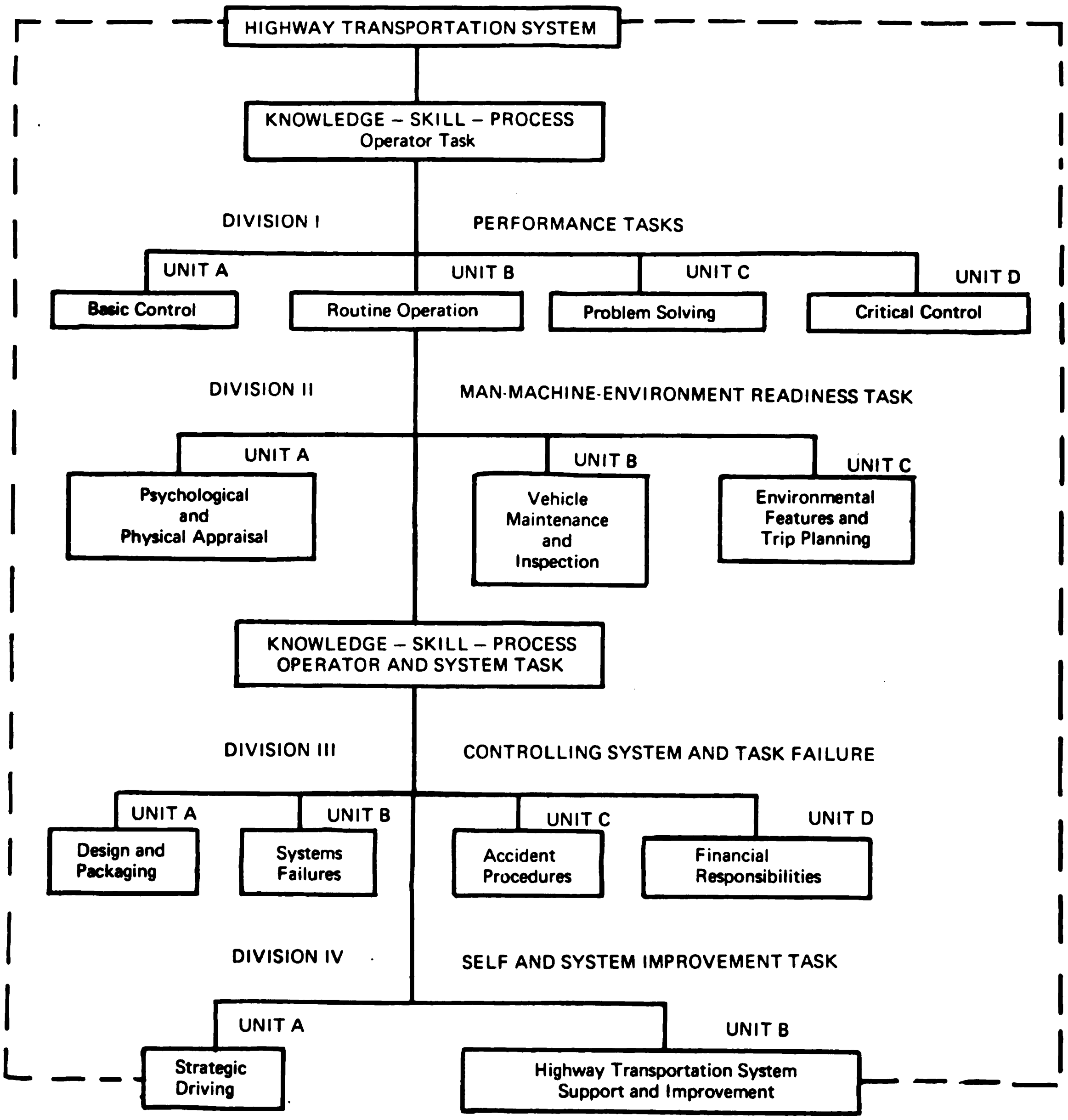

Figure 16.--Major instructional units in traffic education.

such a manner that mastery of one unit is a prerequisite for following units on either a performance or motivational criteria. The curriculum model is further structured to provide for both horizontal and vertical flow. Each unit (horizontal) in a division assists in accomplishing subsequent units, and each division (vertical) assists in accomplishing subsequent divisions. The units and divisions are task oriented in terms of necessary knowledge and performance skills to be obtained by the potential motorists.

It should be apparent that only unit and division titles are provided in the model. Hence, detailed content will need to be developed for these units.

The assigning of content to laboratory or classroom and the interrelation of the units for classroom and laboratory instruction will need to be defined. However, in a general sense, division 1 should be accomplished in laboratory with classroom interrelated and integrated. Division 2 is designed primarily for classroom instruction. Divisions 3 and 4 are designed primarily for classroom instruction with some laboratory instruction.

Summary

The six preceding sections were proposed as a theoretical basis for curriculum development in traffic education for beginning motorists. The models were not designed to be all conclusive, but an attempt was made to provide a conceptual framework for traffic education. This material could provide a starting place for traffic educators to further define and structure objectives and content for traffic courses for beginning drivers.

CHAPTER IV

THE FINDINGS

Chapter IV contains the findings based on the responses of the three expert judges who reviewed the traffic education curriculum material and the course of study for traffic education. The course of study consists of objectives and instructional content. In addition to objectives and content, content for both laboratory and classroom instruction is identified in this chapter. Those content areas which require instructional integration and correlation of classroom and laboratory instruction are also indicated in a parallel presentation. Comments and observations made by the expert judges which pertain to the course of study are identified prior to the outlining of each instructional unit.

The course of study should serve as a guide for teachers, not an an entire curriculum. The traffic education teacher who uses this course guide will have the task of determining method, time allocation, degree of detail for content treatment, and the need for simulated or actual driving experience. Further, the objectives are titled enabling and performance objectives. In writing the objectives performance terminology of either "can" or "will" was employed. However, this project was an initial stage of curriculum development. Hence, the objectives should serve only as a guide for determining exact behavioral objectives. The stating of exact behavioral objectives for daily lesson planning was considered as a next step in curriculum development and was not included in this project. If the course of study is further developed by curriculum specialists or driver education teachers, the objectives should be detailed and stated in operational terms to include the terminal behavior, the conditions for performance, and a measurable criterion.

Findings Based on Judges' Review

This section contains the responses of the judges to the three questions provided to guide their critiques plus a summary of the judges' critiques as they pertain to the course of study. The judges' reviews of the material covered the six sections contained in Part I of Chapter III entitled "Curricular Models." In their review, some of the judges made comments regarding the models that were previously incorporated into Part II, "The Course of Study." These comments are included in the judges' responses to the three guide questions.

<u>Responses From the Expert Judges</u>

Responses from the three judges regarding the review questions follow:

Question 1: <u>Does the material reflect what a beginning motorist should know or should be able to perform</u>? The judges reported that the topics of interrelation of functions, the input classification, and the distinction between the kinds of perception were necessary for a beginning motorist to know.

The judges felt that the content in the models was important. One judge reported that the content and context of the project was excellent and for the most part was what a beginning driver should be taught. He further indicated that the content and sequence of the skills in Models A and B were the most helpful. Parts IV and V (Interacts with other operator-vehicle units and maintains control when confronted with contingencies and conditions) were the sections of Model B that received the most favorable comments. Another judge indicated that Models A and B would serve as a foundation for training the driver's human functions.

Question 2: <u>Is this approach to curriculum development appropriate for driver education</u>? The reviews of the judges indicated that the approach to traffic education curriculum development was appropriate for the most part. In response to the task descriptions, one judge felt the approach was effective. He said that the task descriptions would aid in curriculum development, would assist in identifying human functions required for motor vehicle operation, and that the task descriptions would aid in developing a performance criteria.

The judges indicated that the unit structure was also appropriate. All judges felt that the unit structure would help driver education teachers. In reference to the unit structure, one judge stated that a driver education teacher should be able to develop a driver education curriculum from the models. However, there was a question of the appropriateness of this approach that depended on the objective of the project. It was felt that if the objective of the curriculum models was to aid driver education teachers in planning their teaching the program would be unsuccessful. The judge indicated that teachers lacked the time and imagination to progress from the conceptual curriculum structure to a day by day plan for teaching.

Question 3: What suggestions or recommendations do you have for improving the project? The judges' suggestions for the improvement of the project included specific and general topics. The judges felt that the topic of perception should include two areas: (1) The treatment of perception should have covered the potential as well as the existing hazards confronting an operator. The judge felt that the change in emphasis would allow a driver to plan in advance of driving situations. This emphasis on perception was conceptualized as the defensive driving technique or as driver tactics and strategies; (2) One judge felt that perception should be linked to specific environmental characteristics. He indicated that perceptual abilities and knowledge of driving environments could be developed simultaneously.

The general comments for improving the project were:

1. Define the term traffic education. One judge stated that traffic education and traffic educators should be defined either when the models were presented or elsewhere in the study.
2. Establish a separate unit on man and information storage. One judge felt that information storage and retrieval was a separate human function required of a motor vehicle operator.
3. Develop a rationale for the introduction of psychological factors. One judge felt that a rationale for when to teach the unit on psychological factors would aid the teacher. He further suggested that the unit be taught following the unit containing general abilities required of the operator.

4. Explain the content within the unit structure. This judge felt the unit structure was logical, but that a brief statement of content for each unit would be helpful for a driver education teacher. This reference was to Figure 16, page 138.

5. Develop a college program based on this curriculum approach. One judge felt that this curriculum structure should be included in college and university course offerings. He further felt that the curriculum structure should be treated in workshops throughout the country.

<u>Summary of Judges' Comments by Division and Unit</u>

The judges made observations and comments in their critique of the curriculum models which had bearing on the unit and divisional structure of the course of study.

The reactions of the judges to the curriculum models, outlined in Figure 16, page 138, as the models related to the course of study Overview Division, Highway Transportation System, and Division I, Performance Tasks, Units A, B, C, D follow:

1. <u>Overview Division, Highway Transportation System</u>
   In the judges' critiques pertaining to the overview of the highway transportation system,

the reviews focused on the objective of driver education, the objective of the highway transportation system, and the relation between the education and transportation objectives. One judge stated that the objectives were acceptable. Another judge questioned the need for a beginning driver to know the objective of the highway transportation system. The final judge believed that the highway transportation system objective was adequate, but that driver educators had failed in developing educational objectives.

2. <u>Division I, Performance Tasks, Unit A, Basic Control</u>

   The basic control tasks of the operator as presented in the curricular models were acceptable to the judges. The judges approved of the skills and the skill sequence contained in Model A, and the visual input classification.

3. <u>Division I, Performance Tasks, Unit B, Routine Operation</u>

   The routine operations of the operator as presented in the curricular models were acceptable to the judges. The judges approved of the skills and skill sequence contained in Model A and the visual input classification.

4. Division I, Performance Tasks, Unit C, Problem Solving

   The problem solving tasks relating to perception of hazards, sequence of human functions, visual input classification, and the procedures and processes contained in Model B were acceptable to the judges. However, the emphasis and nature of developing driver judgmental abilities was questioned. Specifically the judges felt more emphasis should be placed on driver experiences and road-traffic characteristics and less emphasis on motor vehicle law as a basis for making driver judgments.

5. Division I, Performance Tasks, Unit D, Critical Control

   The critical control tasks contained in Model B were approved by the judges. However, one judge felt the method of training should stress cognitive problem solving and simulated situations.

The reactions of the judges to the curriculum models, outlined in Figure 16, page 138, as the models related to the course of study Division II, Man-Machine-Environment Readiness Task, Units A, B, C follow:

1. Division II, Man-Machine-Environment Readiness Task, Unit A, Psychological and Physical Appraisal

   A variety of responses were received from the judges concerning this unit. One judge questioned the need for a driver to be aware of psychological and physical information concerning the driver because of the low correlation of such characteristics and accident involvement. A second judge felt a rationale for when to teach the psychological and physical appraisal unit was needed. However, this judge believed there was a logical relation between such factors and driving. Another judge accepted the psychological factors model and the unit structure.

2. Division II, Man-Machine-Environment Readiness Task, Unit B, Vehicle Maintenance and Inspection

   The responses of the judges to this unit were limited. Two judges did not comment, and one judge felt the unit was acceptable.

3. Division II, Man-Machine-Environment Readiness Task, Unit C, Environmental Features and Trip Planning

   The responses of the judges to this unit were limited. One judge felt the unit was necessary in driver education. Another judge felt trip planning was significant in driver education. The third judge did not comment on the unit.

The reactions of the judges to the curriculum models, outlined in Figure 16, page 138, as the models related to the course of study Division III, Controlling System and Task Failure Units A, B, C, D follow:

1. The same response from the judges was made concerning all four units, Unit A, Design and Packaging, Unit B, System Failures, Unit C, Accident Procedures, Unit D, Financial Responsibilities, in Division III, Controlling System and Task Failure. One judge did not comment on the units of the division. The second judge accepted the units and unit structure contained in Division III. The third judge reacted favorably to the units.

The reactions of the judges to the curriculum models, outlined in Figure 16, page 138, as the models related to the course of study, Division IV, Self and System Improvement Task, Units A, B follow:

1. Division IV, Self and System Improvement Task, Unit A, Strategic Driving

   In response to this unit, one judge felt the emphasis should be altered to include both strategies and tactics of driving. Another judge expressed the idea that the development of strategic driving within the structure of self and system improvement tasks was acceptable. The third judge did not comment on the unit.

2. Division IV, Self and System Improvement Task, Unit B, Highway Transportation System, Support and Improvement

   One judge felt that the method of teaching for this unit should be expanded to include problem solving situations. A second judge accepted the unit structure, and the concepts presented in the model depicting the relationship between the managerial sub-systems of the highway transportation system and general operator abilities. The third judge did not comment on the unit.

The Course of Study

The Course Objective

To prepare the learner to perform the sub-tasks required in driving in a competent manner and to enter the highway transportation system with potential for growth as a competent and responsible person in both operator and non-operator roles.

Overview: The Highway Transportation System

The overview of the highway transportation system should consist of a brief identification of system concepts, road users, objectives, and evaluation. The basic purpose is to identify driving as part of a highway transportation system endeavor. The overview should be related through projects to the terminal unit, "Highway Transportation System Support and Improvement."

Judges: One judge questioned the need for beginning drivers to know the objective of the highway transportation system. A second judge indicated that the objectives of driver education should be derived from the objective of the highway transportation system and that the problem of communicating the objective of the highway transportation system did not originate with the highway transportation system objective but in the failure of determining educational objectives. Another judge indicated that the driver education objective and relation of the objective to the highway transportation system was accepted.

<u>Enabling Objectives</u>

The beginner will:

1. identify and define in general terms existing systems;
2. identify components of the highway transportation system at the man-machine-environment level;
3. define the goals of the highway transportation system;
4. identify major managerial sub-systems of the highway transportation system;
5. define criteria for evaluating the highway transportation system's effectiveness; and
6. describe the highway transportation system employing system elements.

Performance Objective

The beginner can:

1. define the highway transportation system as a man-machine system with the purpose of safe, efficient, and convenient movement of people and goods from place to place along given highways.

Content

1. The Highway Transportation System

    A. Systems
        1. definition of systems
        2. kinds of systems
        3. purpose of systems
        4. evaluation of systems

    B. Highway Transportation System
        1. components of highway transportation system
            a. man
            b. machine
            c. environment
        2. goals and purpose of highway transportation system
            a. safety
            b. efficiency
            c. convenience
        3. management of highway transportation system
            a. forces
                1. local
                2. state
                3. federal
            b. tools
                1. laws and ordinances
                2. legislation
                3. standards
            c. interaction of forces
        4. evaluation of the highway transportation system
            a. criteria for evaluation
                1. number of people and amount of goods moved
                2. roadway access
                3. time to move between locations

b. performance of system and management
   1. design
   2. operation
   3. conjestion
   4. delay
c. performance of system and the individual
   1. stress
   2. errors
   3. fatigue
   4. safety
d. cost
   1. training
   2. accident frequency
   3. loss of life and resources

Division I, Performance Tasks, Unit A, Basic Control

The unit on Basic Control is the first laboratory oriented unit, and is the first unit that depends on classroom and laboratory integration.

Judges: The response from one judge was favorable towards the skill sequence for basic control and the classification of input for driver sensing. Another indicated that Models A and B reflected what a driver should know, they were easy to follow, and the content was well sequenced.

Enabling Objectives

The beginner will:

1. identify and define the natural forces which affect driving;
2. identify the factors associated with man-machine-environment which could minimize

or maximize the influence of the natural forces;

3. define the positive relationship between the forces and the basic control task;
4. identify and describe the controls, devices, and instruments necessary for automobile control; and
5. define the traffic and equipment laws related to the basic control task.

Performance Objective

The beginner can:

1. operate the controls of the vehicle under the supervision of an instructor, in a simulated and in an actual highway environment for pre-start, start, move, guide, and securing a motor vehicle.

Content

Classroom

I. Natural Forces Effecting the Control Task

- A. Friction
- B. Gravity
- C. Inertia
- D. Centrifugal

II. Sub-system Factors and Vehicle Control

- A. Vehicle
  1. tires
  2. brakes
  3. steering
  4. suspension
  5. speed
  6. vehicle design
- B. Road and Environment
  1. weather
  2. substance
  3. surfaces
  4. condition

III. Influence of Forces

- A. Moving
- B. Stopping
- C. Changing Directions

IV. Seeing Techniques

- A. Events
  1. own vehicle
  2. highway

V. Laws

- A. Equipment
  1. brakes
  2. signals
  3. other
- B. Traffic
  1. speed
  2. signalling
  3. parking requirements and restrictions

Laboratory

I. Vehicle Familiarization

- A. Location of Controls
- B. Function of Controls
- C. Relation Between Control and Vehicle Response
- D. Limits of Vehicle Response Because of Natural Forces

II. Pre-operational Checks

- A. Periodic
- B. Outside
- C. Inside

III. Pre-start

- A. Reading Instructions
- B. Adjustments
- C. Setting of Controls
- D. Procedures

IV. Starting

- A. Starting Checks
- B. Starting Procedures

V. Moving Vehicle Procedures

- A. Acceleration Techniques
- B. Braking Techniques
- C. Steering Techniques
- D. Mirror Setting
- E. Mirror Usage

VI. Holds Vehicle in Path

- A. Steering
- B. Seeing Technique
- C. Speed Control
- D. Direction Control

VII. Securing, Procedures

Division I, Performance Tasks,
Unit B, Routine Operations

In order to develop proficiency in routine procedural operations, the classroom and laboratory should be integrated and students should be assigned to each in a systematic manner.

Judges: The response from one judge was favorable towards the hierarchial progression of skills for routine tasks and the systematic treatment of driving events within the input classification. Another judge felt that Models A and B reflected what a driver should know, they were easy to follow, and the content was well structured.

Enabling Objectives

The beginner will:

1. define the procedures for each routine sub-task;
2. identify the senses used in driving;
3. identify the kinds of information received by each sense;
4. define how vision operates in driving;
5. identify the critical cues and driving events in each sub-task;
6. define man-machine-environment impediments for seeing; and
7. identify and define traffic laws that apply to routine procedural sub-tasks.

Performance Objective

The beginner can: 1. perform the routine procedural sub-tasks under the supervision of an instructor in a simulated and in an actual highway environment.

Content

Classroom

I. Routine Sub-task Procedure
   A. Lateral Movements
   B. Hill Parking
   C. Turns
   D. Backing
   E. Turnabouts
   F. Parking

II. Channels for Sensory Information During Performance
   A. Touch and Movement
   B. Balance
   C. Hearing
   D. Smelling
   E. Seeing

III. Information Received
   A. Control
   B. Corrective
   C. Performance

IV. Visual Sense
   A. Observing
   B. Fixation and Movement
   C. Fixed and Blank Stare

V. Input Classification
   A. Own Vehicle
   B. Highway

VI. Impediments of Vision
   A. Man
      1. acuity
      2. distance
      3. color
      4. night
      5. glare
      6. peripheral
   B. Vehicles
      1. view obstructions
      2. design
      3. blind spots
      4. viewing area
   C. Environment
      1. illumination
      2. obstructions
      3. design
      4. natural occurrences

VII. Traffic Laws
   A. Signalling
   B. Lane Changes
   C. Turning
   D. Backing
   E. Turnabouts
   F. Parking
   G. Speed
   H. Signs and Markings

Laboratory

I. Monitoring Input
   A. Own Vehicle
   B. Highway

II. Lateral Movements
   A. Speed Control
   B. Wheel Movements
   C. Signalling Laws
   D. Visual Checks

III. Hill Parking
   A. Wheel Placement
   B. Steering
   C. Legality
   D. Visual Checks

IV. Turns
   A. Placement
   B. Steering
   C. Legality
   D. Seeing
   E. Mirror Usage
   F. Signal Laws
   G. Speed Control
   H. Approach
   I. Lane Selection

V. Backing
   A. Legality
   B. Position
   C. Mirror Usage
   D. Speed Control
   E. Sight Direction

VI. Turnabouts
   A. Kind
   B. Legality
   C. Steering
   D. Position
   E. Sight Direction

VII. Parking
   A. Angle
      1. procedures
      2. techniques
      3. problems
      4. legality
      5. visual checks
   B. Parallel
      1. procedures
      2. techniques
      3. problems
      4. legality
      5. visual checks

Division I, Performance Tasks, Unit C, Problem Solving Operations

This problem solving unit depends on a positive integration of classroom and laboratory instruction. In many instances concepts should be introduced in the classroom and the application made during laboratory. The problem solving operation further depends on knowledge, skills, and general driving abilities. Stored knowledge and content related to the driving process are initiated in the classroom and refined and reinforced in the laboratory. The process of driving is actually applied through the previously identified sub-tasks. The classroom instruction would be based on a visual training media approach. In outline form judgment and decision-making are presented last. In actual teaching these functions would be integrated through the various problem solving tasks of the operator.

Judges: The response from one judge indicated that the emphasis on the judgmental task should be altered. He indicated that less emphasis should be placed on motor vehicle laws and more emphasis on developing driving judgments through experience. The problem solving orientation and human functions were accepted by two judges, especially the treatment of the interrelation of functions. Further, the input classification which extends into problem solving situations received favorable comments. One judge felt that Models A and B reflected what a driver should know, they were easy to follow, and the content was well sequenced.

Enabling Objectives

The beginner will:

1. define the perceptual process required in driving, and identify factors which influence both the physical and mental aspects of the perceptual process;
2. define the principles of perception and factors which influence the perceptual process;
3. identify human functions needed to determine safe and legal speeds and determine how vehicle speed and driving events influence the effectiveness of information processing;
4. define and classify the process involved in perceiving actual traffic situations;
5. perceive and interpret the meaning of traffic signs and other controls and classify the controls by meaning, shape, and color;
6. classify driving events into defined classes of own vehicle, highway, traffic controls, and other users;
7. identify driving events within appropriate defined classes;
8. identify, define, and employ appropriate seeing habits in highway driving;

9. identify and define traffic controls and conditions which frequently exist in highway driving;

10. identify and define procedures for sharing and interacting with other road users in highway driving;

11. identify, classify, and determine legal requirements for intersection controls in city driving and define procedures for performing manuevers;

12. define pedestrian, operator, and pedestrian-operator responsibility for simultaneous use of the roadway;

13. define vehicle and trip preparation necessary for expressway driving;

14. describe entrance and exit ramps on expressways and identify procedures necessary to manuever each kind of ramp;

15. identify and define signs and speed laws for expressway driving;

16. define how to park and mark a disabled vehicle on an expressway;

17. define the relationship between operator judgments and driving, and define factors which influence operator judgments;

18. identify and define how the knowledge of laws, human characteristics, and vehicle and road capabilities aid in operator judgments;
19. define how judgment of own vehicle functioning can assist in safe operating conditions;
20. make time-space judgments in manuevers or intersecting right-of-way situations;
21. define and judge other operator behavior in given situations;
22. define the elements of decision-making;
23. define the principles of decision-making;
24. define the relationship between decision-making and operator risk acceptance; and
25. define the relationship between operator decision-making and automatic response.

Performance Objectives

The beginner can under the supervision of an instructor:

1. identify the principles of perception, define the perceptual process, and employ attention and alertness while operating an automobile.
2. determine that perception takes time and that time needed to perceive driving events can be lessened by the selection of critical driving cues on the basis of instruction and experience.

3. identify and define the meaning of traffic controls and can respond to controls appropriately.
4. define and classify driving input into defined classes and perceive and respond correctly to events in simulated and actual driving situations.
5. control his vehicle at legal speeds and employ correct amount of speed in driving.
6. safely interact in highway, city, and expressway driving employing correct procedures and making adjustive responses in simulated and actual situations.
7. assess judgment situations in any driving environment as the judgment relates to laws, vehicles, roadways, manuevers, malfunctions, other operator's behavior, and hazards.
8. make his own decisions in driving when confronted with alternate operator choices.

Content

Classroom	Laboratory
I. Perceptual Process	I. Identification of Traffic Controls
A. Definition of Perception	A. Classification
B. Relation to Vehicle Operator	B. Meaning
1. guidance	
2. feedback	
	C. Location
	D. Means of Recognition
II. Principles of Perception	II. Speed, Perception, and Driving Process
A. Attention	A. Based on Kinds of Vehicles
B. Alertness	B. Based on Environments
C. Time	C. Common Speeds
D. Selection	D. Speed and Information Processing
E. Meaning	E. Speeds and Manuevers
	F. Reasons for Speed Regulations
III. Perception of Input (Groupings)	III. Perception of Input (Groupings)
A. Own Vehicle	A. Own Vehicle
B. Highway	B. Highway
C. Traffic Controls	C. Traffic Controls
D. Other Users	D. Other Users
IV. Set or Expectancy of Environment Input (Mental Set)	IV. Set or Expectancy of Environment Input (Mental Set)
A. Highway Driving	A. Highway Driving
1. seeing techniques	1. seeing techniques
	a. systematic
	b. situational
	c. environmental
2. input classes	2. signs and markings
	a. warning
	b. regulatory
3. speed	3. features and situations
	a. surfaces
	b. speed
	c. right-of-way
4. on-coming traffic	4. interacting with other users
	a. lane control
	b. speed control
	c. enter and exit conditions
	d. meeting vehicles
	e. enter and leave curves
	f. following distance
	g. passing
	h. being passed
	i. hill driving
	j. traffic mix
	k. train-car intersections
5. passing	
6. intersections at grade	
7. curves	
8. hills	
9. warning signs	
10. slow moving vehicles	

11. secondary roads
12. narrow bridges
13. rail crossings
14. variety of surfaces
15. various shoulder conditions

B. Procedures for Operating (Interacting)

C. Legality of Manuevers

D. Problem Solving

E. City Driving
   1. seeing techniques
   2. input classes
   3. input and situations
      a. heavy traffic volume
      b. lane signals
      c. traffic signals
      d. pedestrians
      e. obstructions
      f. lane markings
      g. signing
      h. reversed traffic flow
      i. channelization
      j. one-way streets

B. City Driving
   1. seeing techniques
      a. systematic
      b. situational
      c. environmental
   2. increased input resulting from:
      a. traffic
      b. pedestrians
      c. intersections
      d. parking
      e. control devices
      f. manuevers
   3. traffic controls
      a. right-of-way
      b. legal requirements
      c. meaning
   4. pedestrians
      a. right-of-way
      b. vulnerable
      c. age
      d. patterns
   5. manuevers and legal requirements
      a. lane selection and usage
      b. lane changing and passing
      c. intersection observations
      d. turning
      e. right-of-way

C. Expressway Driving
   1. seeing techniques
      a. systematic
      b. situational
      c. environmental
   2. vehicle and trip preparation
   3. speed laws
      a. minimum
      b. maximum
   4. entrance and exit usage
      a. diamond
      b. cloverleaf
      c. others
      d. entering freeway
         1. hazards of entering
         2. lane selection
         3. merging
      e. leavinr freeway
         1. hazards of leaving
         2. speed
      f. emergency stops and disabled vehicle

k. alleys and drives
l. intersections
4. driving procedures
5. legality of manuever
6. problem solving

F. Expressway Driving
1. seeing techniques
2. input classes
3. input and situations
a. higher speeds
b. multiple lanes
c. overhead signing
d. sign colors
e. merging conditions
f. ramps and kinds
g. limited access
h. high speed lanes
i. rest area
j. toll gates
4. vehicle preparation and trip planning
5. driving procedures
6. legality of manuever
7. problem solving

V. Judgmental Process

A. Definition
B. Process
C. Kinds of Driving
D. Factors Influencing Judgment
E. Stored Knowledge
F. Application in All Driving Environments
G. Required in Specific
H. Laws Influencing Dynamic Judgments
I. Conditions and Contingencies
J. Judgmental Training

V. Judgment in Driving

A. Recognizes and Applies Rules of Road
B. Communication Between Operators
C. Judging Meaning of Signs, etc.
D. Speed of Own Vehicle
E. Speed of Others
F. Vehicle Capabilities
G. Natural Laws
H. User Characteristics
I. Immediate Situation
J. Hazards
K. Manuevers
1. passing
2. intersecting
3. meeting
4. stopping
5. blending
L. Environmental Design and Conditions
M. Own Vehicle Functioning
N. Time and Space Determination

VI. Decision-Making Process

A. Definition
B. Process
C. Principles
D. Risk Taking
E. Automatic Response
F. Driver Responses
1. braking response
2. steering response
G. Habit Formation
H. Application to Trip Objective
I. Application to Situation, Environment
J. Problem Solving

VI. Decision-Making and Driving

A. Operator Choices
B. Selects Proper Control
C. Uses Controls in Proper Sequences
D. Selects Best Alternative
E. Minimizes Hazards and Assesses Risk
F. Controls the Situation
G. Makes Own Operator Decisions
H. Plans Actions in Advance
I. Follows Planned Course

Division I, Performance Tasks, Unit D, Critical Control Operations

This section contains many concepts that may require treatment in either a classroom or simulated environment. However, some conditions must be coped with through on-street instruction as natural occurrences.

Judges: The response from the reviews did not alter the content for this unit, but observations regarding method were stated. One judge felt the method of teaching should include simulated situations, cognitive problem solving, and case studies. Another judge stated that the rationale for selecting and teaching critical tasks in driver education was good.

Enabling Objectives

The beginner will:

1. define and describe the conditions and problems of lessened visibility in night driving;
2. identify and determine appropriate means of compensating for darkness as an operator;
3. identify and determine procedures for interacting with other highway users in low visibility;
4. identify driving procedures in conditions of lessened visibility not imposed by darkness;
5. identify faulty visibility equipment and determine when to replace equipment;

6. identify problems and procedures for operating in snow, fog, and rain as it effects highway user's behavior, vehicle control, and visibility;
7. define procedures for freeing a stuck vehicle in snow, mud, sand; define procedure for preventing a vehicle from becoming mired;
8. define procedures for controlling a vehicle in acceleration and deceleration skids;
9. define conditions and identify means of preventing a vehicle from hydroplaning;
10. define the kinds of brake failures and identify the symptoms of failure with probable failures;
11. define what to do in the event of steering loss and how to cope with steering control in the event of a tire failure;
12. define the procedures to follow if the accelerator pedal sticks, the brakes fail, or the headlamps fail;
13. define procedures for involuntarily leaving and re-entering the roadway;
14. define procedures for starting a stalled vehicle in traffic; and
15. demonstrate appropriate seeing techniques when confronted with lessened visibility and traction.

Performance Objectives

The beginner can under the supervision of an instructor:

1. operate a vehicle in simulated and actual driving during conditions of lessened visibility.
2. employ correct and legal procedures under conditions of lessened visibility and traction even when other road users fail to exhibit self-control.
3. determine the effect of the elements on vehicle traction and control his vehicle when confronted with actual or simulated loss of traction.
4. control his vehicle in simulated and actual conditions with minimum consequences when reacting to a vehicle failure.

Content

Classroom

I. Conditions of Lessened Visibility

A. Night Driving
1. reduced vision
2. visual adaptation
3. overdriving headlamps
4. judgment of speed
5. highway lighting
6. glare
7. interior lights
8. smoking
9. speed
10. headlamps
    a. aiming
    b. cleaning
11. legality of lamps
12. use of sun glasses
13. emergency flashers and vehicle marking
14. headlamps of other operators
15. pedestrian problems

B. Weather
1. speed laws
2. visual distortions
3. reduced view
4. vision
5. visibility equipment
    a. regulation
    b. usage
    c. repair

II. Conditions of Lessened Traction

A. Snow and Ice
1. starting
2. stopping
3. change direction
4. pedestrian behavior
5. temperature changes

B. Fog and Rain
1. traction
2. sensory feedback
3. vehicle failure
4. foreign substances

C. Stuck Vehicle
1. prevention
2. equipment
3. freeing

D. Skidding
1. kinds
2. procedures

Laboratory

I. Conditions of Lessened Visibility

A. Night Driving
1. seeing techniques
2. lighting
    a. legality
    b. usage
3. concealed objects
4. headlamps
5. operating on curves
6. reading panel display
7. legal speeds
8. meeting on-coming vehicles
9. overtaking and passing
10. following vehicles

B. Weather
1. speed control and adjustments
2. use of lights
3. seeing techniques
4. maintaining sight
    a. wipers
    b. washers
    c. defrost

II. Conditions of Lessened Traction

A. Snow and Ice
1. acceleration techniques
2. braking techniques
3. steering
4. hazards
5. surface testing

B. Fog and Rain
1. visual techniques
2. road types
3. engine and brake testing
4. speed for conditions

C. Stuck Vehicle
1. rocking
2. application of power
3. spinning
4. slowing or stopping

D. Skidding
1. braking
2. accelerating
3. steering

E. Hydroplaning
   1. definition
   2. causative factors
   3. preventing and responding to planing

III. Vehicle Failures

A. Breaking Failure
   1. sinking
   2. fading
   3. spongy
   4. grabbing
   5. wet
   6. mechanical

B. Corrective Procedures
   1. pumping
   2. park brake
   3. downshifting
   4. escape route

C. Steering Failure
   1. vehicle stalls
   2. power steering
   3. preventive maintenance

D. Tire Failure-Steering
   1. front
   2. rear
   3. direction of pull
   4. blow out
   5. securing vehicle
   6. prevention
   7. tire options

E. Accelerator Pedal Sticks
   1. causes
   2. procedures

F. Headlamp Failure
   1. checking
   2. replacing
   3. cleaning
   4. procedures during failure

G. Engine Stalls
   1. conditions
      a. stop and go traffic
      b. turning and pressing traffic
      c. time is limited
   2. procedures

H. Run-off-the-road
   1. lost control
      a. causes
   2. pushed off road
      a. stopping
      b. on-coming vehicle
   3. left by desire
   4. decisions and alternatives
   5. consequences
   6. procedures
   7. re-entry
   8. operating when other traffic leaves road
   9. factors influence control and operator procedures

E. Hydroplaning
   1. vehicle control
   2. speed adjustments
   3. direction control
      a. passing
      b. lane changing
      c. curves

III. Vehicle Failures

A. Braking Failure
   1. test
   2. symptoms
   3. procedures

B. Minimize Consequences
   1. low speeds
   2. low gear

C. Steering Failure
   1. quick start procedures
   2. starting drill
   3. signs and symptoms

D. Tire Failure-Steering
   1. procedures
      a. steer straight
      b. grip wheel
      c. engine braking
      d. brake pumping
      e. select safe route
   2. replacement

E. Accelerator Pedal Sticks
   1. procedures
   2. precautions

F. Headlamp Failure
   1. pre-drive check
   2. high low beam
   3. switch and dimmer location
   4. procedures during failure

G. Engine Stalls
   1. simulated conditions
   2. procedures

H. Run-off-the-road
   1. moving vehicle leave roadway
      a. procedures for leaving
      b. procedures for re-entry
   2. identifying hazardous features
   3. steering and braking control

Division II, Man-Machine-Environment Readiness Task, Unit A, Psychological and Physical Appraisal

This unit is primarily a classroom unit with opportunities available for students to express their feelings. However, many behavioral characteristics and cues to future driving behavior will be demonstrated by the student in the laboratory.

Judges: The response from the reviews questioned the section on psychological and physical factors. One judge's question focused on whether or not a driver needs to be aware of physical attributes (vision) and his psychological make-up as measured by test instruments. This question was raised because of the low correlation between psychological and physical factors and accident causative factors. Further, one judge suggested that the title be expanded to include social factors and the method be expanded beyond an attitudinal approach to include problem solving. Another judge commented that the unit structure was acceptable, easy to follow, and allowed for additional development by the driver education teacher. Further, the structure permitted the adding of future driver education concepts.

Enabling Objectives

The beginner will:

1. identify and define internal forces which determine or influence his behavior;

2. recognize temporary and permanent personality factors in his own make-up;
3. identify and describe his personal code of behavior which would allow for both expression and control of internal factors at appropriate times;
4. identify and describe significant physical factors which influence operator performance and define precautionary measures for minimizing the hazards involved in driving;
5. identify and classify the sources and nature of fatigue; predict effects of fatigue on driving; and identify measures to prevent driving fatigue or fatigue from impairing driver performance;
6. define how various major disabilities relate to the ability needed in driving;
7. describe what happens to ethyl alcohol when consumed, and to classify the variables which affect this process;
8. classify and describe the effects of alcohol on body functions;
9. identify the relation between accidents and alcohol and determine the effects of alcohol on the general abilities required in driving;
10. identify and describe the reasons for chemical tests and levels of intoxication;

11. assess the role of alcohol usage with youth and determine the problems of youthful driving and drinking; and
12. classify various kinds of drugs, identify the effects on body functions, and predict the possible consequences of drug misuse for a highway user.

<u>Performance Objectives</u>

The beginner can:

1. identify internal elements and acts of expression which facilitate operator performance and identify those which interfere with his capability (general ability) to perform as a highway user; assess his behavior and driving behavior in order to make optimum use of his assets and to compensate for his liabilities as a highway user.
2. identify the effects of internal and external physical factors on the process of driving and define a set of procedures for compensating for physical factors.
3. define and subscribe to a set of principles to guide his behavior when confronted with situations that suggest the use of alcohol/ drugs when driving and in other activities.

Content

I. Internal Factors

A. Temporary Psychological Factors
1. risk
2. peer influences
3. driver irritations
4. driver confidence
5. competiveness
6. defensiveness
7. emotional disturbances
8. worry

B. Permanent Psychological Factors
1. personality
2. attitude
3. motivation
4. values
5. self-concept
6. feelings
7. maturity

C. Appraisals
1. self-expression
2. self-control

II. Physical Factors Internal and External

A. Major Disabilities
1. epilepsy
2. heart disease
3. diabetes
4. hearing and visual deficiencies

B. Minor Health Problems
1. colds
2. hay fever

C. Carbon Monoxide
D. Smoking
E. Fatigue
F. Drowsiness
G. Monotony

III. External Factors

A. Alcohol
1. absorption and distribution
2. effects on body functions
3. accident data
4. alcohol and youth
5. intoxication and testing
6. reasons for drinking and driving
7. assessing alcohol usage
8. influence on operator performance

B. Drugs
   1. types and classification
   2. abuses
   3. uses
   4. effect
   5. over-counter consumption
   6. drug combinations
   7. effect on body function
   8. influence on operator performance

IV. Influence on Operator Behavior and Performance

   A. Sensory
   B. Perceptual
   C. Judgmental
   D. Decision-Making

<u>Division II, Man-Machine-Environment Readiness Task, Unit B, Vehicle Maintenance and Inspection</u>

This unit contains content for both classroom and laboratory instruction. The basic information should be presented in the classroom with application of information in the laboratory.

Judges: One judge stated that the unit structure was acceptable, easy to follow, and allowed for additional development by the driver education teacher. Further, the structure permitted the adding of future driver education concepts.

<u>Enabling Objectives</u>

The beginner will:

1. identify when his vehicle in malfunctioning and is in need of maintenance;
2. define procedures necessary for maintaining one's own motor vehicle in operating condition; and

3. develop a maintenance and inspection schedule.

Performance Objectives

The beginner can:

1. recognize the need for a safe vehicle.
2. maintain his vehicle in such a manner as to protect himself and other highway users.

Content

Classroom

I. Signs and Symptoms and Vehicle Systems Malfunctioning

- A. Ignition System
  1. starting
  2. power
  3. tune up
- B. Fuel System
  1. engine smoothness
  2. starting
  3. compression and power loss
  4. acceleration capability
- C. Suspension System
  1. vibrations
  2. tracking
  3. sway
  4. wheel bounce
  5. stability
- D. Oil and Filtration Systems
  1. level
  2. tire
  3. mileage
  4. pressure
- E. Brakes
  1. low
  2. spongy
  3. fade
  4. screeching
- F. Tires
  1. vibration
  2. wander
  3. wear
- G. Cooling System
  1. slow and fast idle
  2. water level
  3. fan belts
  4. check procedure

II. Maintaining Vehicle

- A. Service
  1. authorized dealer
  2. garages
  3. stations
  4. owner checks
  5. owner's manual
- B. Checks
  1. periodic system checks
  2. trips
  3. seasonal
  4. routine
  5. warranty
- C. Preventive Maintenance and Maintenance Records
  1. service
  2. repairs
  3. warranty

Laboratory

I. Signs and Symptoms and Vehicle Systems Malfunctioning

- A. Ignition System
  1. slow start
  2. grinding
  3. battery care
- B. Fuel System
  1. flooded carburetor
  2. fuel check
  3. setting automatic choke
- C. Suspension System
  1. shock check
  2. suspension evaluation
- D. Oil and Filtration Systems
  1. under hood checks
- E. Brakes
  1. evaluation of brake condition
  2. tire inflation
     a. wear
     b. causes
- F. Tires
  1. steering
  2. wear
  3. rotation
- G. Cooling System
  1. underhood checks
     a. water level
     b. belt wear and tightness

II. Maintaining Vehicle

- A. Location of Systems with Owner's Manual
- B. Checks
  1. inside
  2. outside

Division II, Man-Machine-Environment Readiness Task, Unit C, Environmental Features and Trip Planning

This is a classroom unit which can be supported through laboratory instruction. In the laboratory, students can drive to their own trip problem. This would be an advanced lesson and should incorporate many concepts from previous classroom and laboratory lessons.

Judges: The response from one judge was favorable in regard to the concept of "trip planning." Another judge stated that the unit structure was acceptable, easy to follow, and allowed for additional development by the driver education teacher. Further, the structure permitted the adding of future driver education concepts.

Enabling Objectives

The beginner will:

1. define his own trip objectives;
2. define the highway transportation system's objective;
3. read map symbols and plot a course of travel;
4. describe the three environments (expressway, city, rural) in terms of their characteristics; and
5. identify kinds of driving (hill, desert) within a trip.

Performance Objectives

The beginner can:

1. define the advantages and disadvantages of each roadway environment.
2. plan a safe trip within his personal objectives which are compatible with the highway transportation system objective.

Content

Classroom

I. Trip Objectives

- A. Cost
- B. Time
- C. Purpose
- D. Special Equipment
- E. Driver Experience

II. Course Plan

- A. Map Symbols
- B. Route Selection
- C. Stops
  1. lodging
  2. rest
  3. services
- D. Exit Indication
- E. Alternate Routes
- F. Availability of Services
- G. Terminal Points

III. Driving Environments

- A. Expressway-City-Rural
  1. road surfaces
  2. lanes
  3. characteristics
  4. entry
  5. exit
  6. function
  7. accident frequency, severity, and kind
  8. inherent hazards
  9. induced strain and tension on operator
  10. design differences
- B. Special Conditions
  1. hill driving
  2. mountain driving
  3. desert driving
  4. changing conditions

Laboratory

I. Trip Objectives

- A. Vehicle Checks
- B. Equipment Checks
- C. Pre-Drive and Drive Inventory

II. Driving Environments

- A. Trip Execution
- B. Destination Driving
- C. Sustained Operations
- D. Night Driving
- E. Procedures for Special Conditions

Division III, Controlling System and Task Failure, Unit A, Design and Packaging

This unit focuses on design and packaging concepts which protect vehicle occupants. An information base would be established in the classroom and reinforced through application during laboratory instruction. The unit further has behavioral overtones which should influence the attitude of the beginning motorists.

Judges: One judge commented that the unit structure was acceptable, easy to follow, and allowed for additional development by the driver education teacher. Further, the structure permitted the adding of future driver education concepts.

Enabling Objectives

The beginner will:

1. identify and define the natural forces which contribute to injury severity in crash situations;
2. identify and support the rationale for safety devices and equipment in motor vehicles;
3. define proper use of restraining devices and defend the use of such devices;
4. identify the accident and injury prevention qualities of restraining devices; and
5. describe the concept of packaging to include the interior features of a vehicle.

<u>Performance Objectives</u>

The beginner will:

1. require the best packaging devices on the market to be installed in his vehicle
2. use restraining and protection equipment in all driving situations.
3. require all passengers to package themselves as safely as possible in his vehicle.

<u>Content</u>

I. Natural Forces

   A. Kinetic Energy
   B. Forces of Impact

II. Packaging Equipment

   A. Standards
      1. crash qualities
      2. testing
      3. required - optional
   B. Protection
      1. windshield
         a. high penetration--restraint
         b. low penetration--restraint
   C. Steering
      1. padding
      2. angle
      3. energy--absorbing
   D. Panel
      1. padding
      2. protruding
   E. Dash
      1. recessed
      2. padding
   F. Doorlocks
      1. protected
      2. usage procedures
      3. lock-unlock conditions
   G. Posts and Supports
      1. padding
      2. resistance

III. Restraining Devices

A. Belts
   1. lap
   2. shoulder
B. Usage
   1. position
   2. tightness
   3. combination
   4. conditions
   5. use and misuse
   6. misconceptions
C. Accident Prevention Qualities (Pre-Crash)
   1. positioning
   2. support
   3. fatigue
   4. stability
   5. security
   6. passengers
      a. movement
      b. distractions
   7. vehicle control
D. Injury Prevention Quality (Crash)
   1. speed effectiveness
   2. probability of protection
   3. nature of injury
   4. distribution of impact
   5. advantage of remaining packaged
   6. second impact
   7. age and size variability

IV. Packaging Concept
A. All Interior Features
B. Restraints
C. Protection for All
D. Liability

<u>Division III, Controlling System and Task Failure, Unit B, System Failure</u>

This is a classroom unit in which the beginner views himself as part of the highway transportation system. As part of the system he, other users, and the system managers play both a positive and negative role in system failure.

Judges: One judge commented that the unit structure was acceptable, easy to follow, and allowed for additional development by the driver education teacher. Further, the structure permitted the adding of future driver education concepts.

Enabling Objectives

The beginner will:

1. identify the kind of errors made in the man-machine-environment level of the highway transportation system and identify the responsibility for these errors;
2. describe the consequences of errors in the highway transportation system;
3. identify methods in which errors and consequences of errors are controlled;
4. define how the motoring public views motor vehicle accidents;
5. define a preventable accident and define an accident in terms of current standards of behavior; and
6. identify the role of the managerial systems in identifying accident causes and prescribing remediation.

Performance Objectives

The beginner can:

1. identify and describe common errors and the causes of errors in the highway transportation system at the man-machine-environment level.
2. identify and describe the consequences of system errors.
3. perform in a manner which would assist in lessening individual and system errors.

Content

I. Kind of Errors

   A. Design
   B. Route
   C. Operator Performance
   D. Highway User Errors
      1. age
      2. sex
      3. activity
   E. System Induced Errors
   F. Deliberate Acts
      1. reckless driving
      2. negligent operation
      3. drag racing
   G. Violations

II. Consequences of Errors (Accident Picture)

   A. Collisions
   B. Injury
   C. Property Damage
   D. Death
   E. Economic Loss

III. Controlling Errors and Consequences

   A. First Aid
   B. Emergency Medical
   C. Identification and Surveillance of Accident Locations

D. Police Traffic Control
E. Operator Removal
    1. points
    2. penalties

IV. Motor Vehicle Accidents

A. Public Appraisal
B. Public Attitudes
C. Misconceptions
D. Definition
E. Preventable Accident
F. Causes
G. Multiple Cause Theory
    1. factors
    2. management interaction
        a. determining cause
        b. remedial efforts

Division III, Controlling System and Task Failure, Unit C, Accident Procedures

This is a brief classroom unit with a critical message in terms of future driver responsibilities. Even the most proficient operators may be involved in accidents in some form.

Judges: One judge commented that the unit structure was acceptable, easy to follow, and allowed for additional development by the driver education teacher. Further, the structure permitted the adding of future driver education concepts.

Enabling Objectives

The beginner will:

1. define procedures to follow in the event he is involved in or comes upon an accident scene;

2. define conditions for reporting accidents;
3. perform in such a manner as to expedite police activities; and
4. perform procedures at an accident scene in order to assist in the continuous flow of traffic and help prevent other collisions.

Performance Objective

The beginner can:

1. determine his moral and legal post-accident responsibilities on any level of involvement.

Content

I. Post Accident Responsibilities--Highway User

   A. Degree of Involvement
      1. driver
      2. passenger
      3. witness
   B. At the Scene
      1. legal requirements
      2. moral duties
   C. Accident Reporting
      1. requirements
      2. nature of report
      3. police report
      4. Secretary of State's report
   D. Consequences for Negative Behavior
      1. leaving the scene
      2. hit and run
      3. responsible and prudent
      4. neglect of duty
      5. proof of responsibility

II. Highway User--Police Interaction

   A. Stopping Procedures
   B. Marking and Controlling Scene
   C. Assisting Injured
   D. Emergency Medical Services

E. Debris Removal
F. Continuing Traffic Flow
G. Accident Investigation
H. Accident Report

Division III, Controlling System and Task Failure, Unit D, Financial Responsibility

The need for financial responsibility is based upon the recognition that there will be failure within the system and that this failure increases the cost for operating the highway transportation system. Each member of the highway transportation system has a moral and legal responsibility to protect himself and other users.

Judges: One judge stated that the unit structure was acceptable, easy to follow, and allowed for additional development by the driver education teacher. Further, the structure permitted the adding of future driver education concepts.

Enabling Objectives

The beginner will:

1. identify the need for financial responsibility;
2. define the requirements for financial responsibility;
3. identify how he can be financially responsible;
4. define the kinds of insurances available to an operator;
5. identify factors which determine the rates of insurance; and

6. determine the different ways and most effective way of showing proof of financial responsibility.

<u>Performance Objectives</u>

The beginner can:

1. define conditions which will permit him to be a financially responsible operator in the highway transportation system.
2. provide protection beyond minimum requirements.

<u>Content</u>

I. Financial Responsibility

  A. Definition of Financial Responsibility
  B. Minimum Financial Responsibility
  C. Duties when Involved in an Accident
  D. Conditions under which Financial Responsibility Law Applies
  E. Requirements of Law

II. Automobile Insurance

  A. Form of Financial Responsibility
  B. Requirement for Financial Responsibility
  C. Nature and Purpose of Automobile Insurance
  D. Types of Protection
  E. Rate Determination
  F. Assigned Risk and Compulsory Plans
  G. Range of Protection

III. State Regulation of Financial Responsibility for Highway Users

  A. Compulsory Insurance Protection
  B. Bonding
  C. Uninsured Motorists Fund
  D. Uninsured Motorists Protection
  E. Future Proof of Responsibility
  F. Penalities and Requirements for Unresponsible Users

Division IV, Self and System Improvement, Unit A, Strategic Driving

This is a classroom unit which provides for a summary of other units and states a plan for future operation beyond the limits of formal instruction. Strategic driving depends on a personal code of behavior and a driving code. This unit should have a positive influence on advanced laboratory lessons and on the student's future driving behavior.

Judges: The response from one judge indicated a need to change the emphasis of strategic driving. The suggested focus would include both strategy and tactics. The suggested driving strategies go beyond a recognition of actual hazards and situations and focus on the potential situations. This approach to strategies allows for the use of stored knowledge and driver general abilities for planning in advance of driving situations. Another judge stated that the unit structure was acceptable, easy to follow, and allowed for additional development by the driver education teacher. Further, the structure permitted the adding of future driver education concepts.

Enabling Objectives

The beginner will:

1. define acceptable levels of risk worth taking in driving;

2. identify a level of perceptual reality which reflects safe driving requirements;
3. identify individual differences in driving and perform in a manner which reflects his strengths in driving;
4. evaluate the competencies of other highway users;
5. define his highway behavior within limits of legal and moral responsibilities rather than allowing group influences to determine his highway behavior;
6. operate a motor vehicle within a mental state which will assist him in being a strategic (defensive) driver with the aim of preventing collisions and congestion;
7. identify the basic principles of accident prevention and apply the principles in driving situations;
8. define strategic (defensive) driving; and
9. define the requirements for strategic driving and apply the requirements in specific traffic situations.

Performance Objectives

The beginner can:

1. reflect sound principles of behavior in his driving and operate a motor vehicle in

such a manner as to protect himself and others against system failure.

2. accept the responsibilities of operator decision-making for the safe and efficient movement of system users as part of his membership requirements in the highway transportation system.

<u>Content</u>

I. Personal Behavior Code

   A. Perception of Reality
   B. Realistic Self Concept
   C. Risk Assessment
   D. Risk Acceptance
   E. Individual Differences
   F. Evaluation of Highway Users
   G. Group Influences on Behavior

II. Strategic Driving Code

   A. Concept of Strategic Driving
      1. driving habits
      2. state of mind
      3. protection
   B. Principles of Accident Prevention
      1. recognition of hazards
      2. elimination of hazards
      3. compensation for hazards
      4. avoid creating hazards
   C. The Need for Strategic Driving
      1. collisions and human errors
      2. complexity of driving
         a. actions of other highway users
         b. weather and road conditions
         c. motor vehicle breakdowns
      3. legal responsibility for accident prevention
   D. The Objective of Strategic Driving
      1. operator control
      2. collision avoidance

E. The Requirements of Strategic Driving
   1. knowledge and observance of laws
   2. efficient sensory habits
   3. ability to perceive, judge, and decide in operating
   4. ability to achieve time-space vehicular placement
   5. ability to make adjustment to conditions
      a. traffic
      b. roadway
      c. weather
      d. illumination
      e. own vehicle
      f. health and state of mind
   6. confidence in personal performance
   7. desire to improve performance

<u>Division IV, Self and System Improvement, Unit B, Highway Transportation System Support and Improvement</u>

This unit covers some of the official support systems in the highway transportation system. The student, as a member of the highway transportation system, will need adequate knowledge which will allow him to intelligently support sound improvements in the highway transportation system.

Judges: The response from the reviews indicated that this unit is necessary in driver education. However, one judge stated that the method of teaching should include problem solving activities. Another judge commented that the unit structure was acceptable, easy to follow, and allowed for additional development by the driver education teacher. Further, the structure permitted the adding of future driver education concepts.

Enabling Objectives

The beginner will:

1. identify the major official support managerial sub-systems of the highway transportation system;
2. define the tools or vehicles these agencies use in performing their system duties;
3. identify how the managerial sub-systems aid the highway users and strive to meet the system objectives;
4. identify the joint or interrelated efforts of the sub-systems in performing their duties; and
5. define how these systems influence highway user membership and assist the operator's task.

Performance Objectives

The beginner can:

1. identify and define the major support systems in the highway transportation system.
2. describe their respective tools (i.e., driver licensing).
3. support the sound efforts of the sub-systems in both operator and non-operator roles.

<u>Content</u>

I. Highway Transportation System Sub-systems

A. State and Local Levels
1. driver licensing
   a. limitations
   b. examinations
   c. re-examinations
   d. driver improvement
   e. revocation, suspension, and cancellations
   f. trends in examination
   g. quality of operator
2. motor vehicle registration
   a. state standards
   b. registration requirements
   c. compliance
   d. penalty related to registration
   e. proof of registration
   f. quality of vehicle
3. motor vehicle inspection
   a. purpose of inspection
   b. kinds of inspection
   c. standards
   d. trends in inspection
   e. quality of vehicle
4. police traffic law
   a. purpose of traffic law
   b. traffic law as a social device
   c. uniformity
   d. operator motivation and the law
   e. traffic law enforcement
      1. tools
      2. procedures
   f. police traffic supervision
   g. operator behavior
   h. quality of operator
5. traffic courts
   a. purposes and procedures
   b. correcting and educating
   c. attitude toward judicial system
   d. quality and enforcement
6. traffic engineering
   a. purpose
   b. highway planning
   c. uniformity
   d. turbulence
   e. warrants
   f. speed zoning
   g. signing

h. relation to operator
i. urban improvement
j. quality of roadway
k. quality of highway user interaction

7. nature of laws and ordinances
   a. legislation
   b. local jurisdiction
   c. quality of standards and officials

B. Federal Role
   1. standards
      a. uniformity
      b. quality of transportation system
      c. financing

C. Operator and Sub-Systems
   1. total support
      a. interrelation of systems
   2. determination of sub-system--safe highway users
      a. screening
      b. removal
   3. sub-system's influence on driver ability and performance
      a. supervision
      b. enforcement
      c. improved system
      d. performance
         1. sensing
         2. perceiving
         3. skilled performance
         4. deciding

D. Private Efforts
   1. individual influences on system
   2. groups
   3. industry
   4. quality of officials
   5. quality man-machine-environment

Summary

This chapter included the objectives and content of a traffic education course of study. This course of study was designed for teachers to use as a guide in content selection.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter contains the summary, conclusions, and recommendations. The conclusions and recommendations were based upon the project in general, the insights the author gained through the process of developing the material, and the responses from the expert judges who reviewed the curricular models.

Summary

Statement of the Problem

The purpose of this study was (1) to develop curricular models depicting a conceptual scheme of traffic education which could be used by teachers in selecting content and providing instruction for future automobile operators and (2) to develop a suggested course of study, including guiding instructional objectives and a content sequence to be used in classes for beginning motorists.

Methods of Procedure

Based on a search of pertinent literature, curricular models which depicted a conceptual scheme of traffic education were produced. Following the construction and description of the curricular models, a suggested course of study, containing both classroom and laboratory content, was derived from the models. Expert judges, who reflected a broad concept of highway traffic safety, were selected to review and critique the traffic education curricular models. The judges' observations were reported and those observations which related to the course of study were identified.

Findings

The following is a summary of the major findings of this study. The findings are reported in terms of positive and negative acceptance of the units in traffic education by one or more judges. The units in traffic education were derived from the curricular models.

1. Positive Responses About Units
    a. Overview: The Highway Transportation System
    b. Division I, Performance Tasks, Unit A, Basic Control
    c. Division I, Performance Tasks, Unit B, Routine Operations
    d. Division I, Performance Tasks, Unit C, Problem Solving Operations
    e. Division I, Performance Tasks, Unit D, Critical Control Operations

f. Division II, Man-Machine-Environment Readiness Task, Unit A, Psychological and Physical Appraisals

g. Division II, Man-Machine-Environment Readiness Task, Unit B, Vehicle Maintenance and Inspection

h. Division II, Man-Machine-Environment Readiness Task, Unit C, Environmental Features and Trip Planning

i. Division III, Controlling System and Task Failure, Unit A, Design and Packaging

j. Division III, Controlling System and Task Failure, Unit B, System Failures

k. Division III, Controlling System and Task Failure, Unit C, Accident Procedures

l. Division III, Controlling System and Task Failure, Unit C, Financial Responsibilities

m. Division IV, Self and System Improvement Task, Unit A, Strategic Driving

n. Division IV, Self and System Improvement Task, Unit B, Highway Transportation System Support and Improvement

2. Negative Responses About Units

   a. Overview: The Highway Transportation System

b. Division I, Performance Tasks, Unit C, Problem Solving Operations

c. Division II, Man-Machine-Environment Readiness Task, Unit A, Psychological and Physical Appraisals

d. Division IV, Self and System Improvement Task, Unit A, Strategic Driving

e. Division IV, Self and System Improvement Task, Unit B, Highway Transportation System Support and Improvement

In summary, each unit derived from the curricular models received positive comments from at least one judge and five units received comments which suggested that a potential driver did not need to know the information or that the content within the units required a change of emphasis for total acceptance.

Conclusions

The following are the conclusions of this project.

1. This approach to curriculum development was assessed by direct opinion, but the actual effectiveness of the curriculum approach can only be measured through controlled experimentation. The judges made comments which indicated that the curriculum approach could be used in driver education. However, many components of the curriculum are new and would require controlled experimentation to determine their effectiveness in driver education.

2. This approach provided for the development of a curriculum structure. The structure required a content sequence of a developmental nature. The altering of the unit sequence would in all probability lessen the effectiveness of the developed curriculum. This is especially true for units sequenced on a performance criteria. Division I, Performance Tasks, provided an example of a unit structure designed on a performance criteria.

3. The teaching behavior or the teacher-learner relationship was not structured by this curriculum approach. A teacher could use this curriculum structure regardless of his philosophical concept of the teaching-learning process. The teacher still needs to determine teaching method for many units in this curriculum structure. The methods could include small group discussion, the discovery method, independent study, and student projects.

4. Teaching media did not exist which could be employed for improving the operator's general driving abilities. The media for this purpose needs to be developed and assessed before this curriculum approach can be entirely evaluated. The general guidelines for developing the media could come from Chapter III and from the expertise of learning theorists. This media should include both visual training media and media which relies on the discovery or inquiry method.

5. The performance objectives by definition tended to indicate that learning had terminated with formal instruction. In actuality the performance objectives did not state terminal learning achievement but permitted continuous growth of the operator during his driving career. Further the performance objectives need to be further developed if they are to be used in an instructional driver education guide. The objectives need to be expanded to include the terminal behavior, conditions for learning, and a measurable criteria.

6. This material was developed to provide guidelines for teachers of traffic education. Hence detailed content and objectives were not developed. It was felt that detailed development would restrict the use of the curriculum structure. However, the curriculum should provide a structure for further curriculum development.

7. If the major units in this curriculum structure are accepted, the current minimum time standards for driver education instruction needs to be re-evaluated. In fact, if some of the attitudinal objectives are to be achieved, driver education would need to be integrated into the school curriculum as well as being treated in a specific course. Traffic education could be incorporated into a K-12 curriculum with specific courses in pre-driver education, driver education, and post-driver education.

8. The driver education curriculum can not be limited to a skill training course. The operator's general behavior or psychological make-up as well as the system in which he performs the driving task influences his performance. Driver education should be viewed as part of the behavioral sciences and taught in terms of its relationship to the highway transportation system.

9. An integrated and correlated classroom and laboratory scheduling method is required in order to employ the curriculum structure and resulting course of study. The most difficult area to employ an integrated and correlated scheduling method is with problem solving tasks and general driving abilities. These two areas, problem solving and general driving abilities, are also the areas which are most dependent upon the integrated and correlated scheduling method for successful learning.

10. The curriculum was based on a theory of traffic education for beginning motorists. The material could be refined and expanded through an interdisciplinary effort in traffic education curriculum development. This curriculum could be developed to the degree that it could serve as the structure for daily planning by driver education teachers.

11. The judges, in accepting or rejecting content within units, tended to reflect their profession within the profession of highway traffic safety. Specifically,

the judges reflected a concept of driver education based upon their professional backgrounds.

12. Some judges focused on specific areas within the curriculum models rather than assessing the entire curriculum structure.

13. Judges' recommendations for improvement in content were identified. The judges did not suggest the position or relationship between their suggested additions and the curriculum structure.

14. Many of the judges' recommendations for improving the project were already included in various chapters and these recommendations would not have been made provided the judges had reviewed the entire project.

15. Division III units received few comments in the judges' critiques because they only appeared in one figure, Figure 9, "Major Instructional Units in Traffic Education." Further these units had a less empirical relationship to driving than other units in the curriculum structure and related to failure rather than successful performance by an operator.

16. All the judges approved the content and content sequence of the units as presented in the model titled, "Major Instructional Units in Traffic Education." However, all the concepts presented in the curricular structure were not accepted.

Recommendations

The following recommendations are made for this project:

1. Determine realistic operator performance criteria for evaluating the product of driver education.

2. Evaluate this curricular structure and other curricular approaches in driver education on the basis of educational objectives rather than with standardized tests.

3. Substantiate this approach to curriculum development by actual field testing and evaluation of results.

4. Determine realistic instructional time for accomplishing traffic education instruction as conceptualized in this curriculum structure.

5. Evaluate this curriculum structure in experimental difference studies.

   a. Measure the effectiveness of this traffic education curriculum when employing the separate scheduling method. This study should be conducted with beginning drivers. The classroom should precede and terminate before laboratory instruction begins.

   b. Measure the effectiveness of this traffic education curriculum when employing the integrated and correlated scheduling method. This study should be conducted with beginning drivers. The classroom and laboratory instruction should be simultaneous.

c. Employing the separate scheduling method, compare the effectiveness of this curriculum structure with the conventional approaches to driver education instruction. This study should be conducted with beginning drivers. The classroom should precede and terminate before laboratory instruction begins.

d. Employing the integrated and correlated scheduling method, compare the effectiveness of this curriculum structure with the conventional approach to driver education instruction. This study should be conducted with beginning drivers. The classroom and laboratory instruction should be simultaneous.

e. Determine which existing laboratory instructional facilities or combination of facilities are most effective when employing this curriculum structure.

6. Make a detailed task analysis of all driver tasks and determine a criteria measure for evaluation.

7. Design a program for systematic re-evaluation of the operator's task as various components within the highway transportation system are added or modified.

8. Design a study to determine if the operator currently has the ability to perform the driver's tasks which are required for automobile operation.

9. Design a study to determine the tasks, sub-tasks, and required operator abilities for operators of all vehicles (two-wheelers, fleet vehicles, etc.) in the highway transportation system.

10. Determine a realistic criteria for the evaluation of driver education on a short and long term basis.

11. Determine the contribution of driver education as an accident counter-measure in the highway transportation system.

12. Develop a driver education program based on this curriculum structure and implement the curriculum structure in schools of various sizes and with various facilities available to accomplish the curriculum goals.

13. Develop textbooks and other instructional materials based on this curriculum structure.

14. Develop and conduct workshops with high school driver education teachers to determine further usefulness of this curriculum approach.

15. Develop this curriculum structure into an instructional guide for driver education including detailed daily lesson plans with measurable behavioral objectives.

16. Encourage high school teachers to further define the traffic education curriculum, especially the

objectives. This recommendation should provide for teachers to begin their detailed development with the conventional elements of driver education. For example, the teachers could start the development with the basic procedural skills in driver education. Their development of units derived from this curriculum structure should include daily plans with measurable behavioral objectives.

17. Encourage state departments of education to consider this curricular structure for designing their state instructional driver education guides.

18. Develop driver education teacher preparation programs based on this curriculum structure. Where driver education preparation programs already exist this curriculum approach should be integrated into the existing structure. In situations where driver education teacher preparation programs are being developed, this curriculum should be employed as the foundation for further development.

BIBLIOGRAPHY

Books

Anderson, William G. In-Car Instruction Methods and Content. Massachusetts: Addison-Wesley Publishing Company, 1968.

Bartley, S. Howard. Principles of Perception. New York: Harper and Row Publishers, 1958.

Crow and Crow. An Outline of General Psychology. Paterson, New Jersey: Littlefield, Adams, and Company, 1961.

Gagne, Robert M. Conditions of Learning. New York: Holt, Rinehart and Winston, 1965.

Gagne, Robert M. Psychological Principles in System Development. New York: Holt, Rinehart and Winston, 1966.

Gibson, James J. The Senses Considered as Perceptual Systems. Boston: Houghton Mifflin Company, 1966.

Haddon, W., E. Suchman, and D. Klein. Accident Research. New York: Harper and Row Publishers, 1964.

Komorita, Samuel, et al. Review Outline of Psychology. Paterson, New Jersey: Littlefield, Adams, and Company, 1962, Third Edition.

Maddi, Salvatore R. Personality Theories. Homewood, Illinois: Dorsey Press, 1968.

Newsletter

Instructional Simulation Newsletter. Teaching Research, Oregon State System of Higher Education, Monmouth, Oregon, Vol. 2, No. 1, February, 1969.

Periodicals

Adelstein, A. M. "Accident Proneness: A Criticism of the Concept Based Upon an Analysis of Shunters' Accidents," Journal of the Royal Statistical Society, Series A, CXV (1952), pp. 354-400.

Babarik, Paul. "Automobile Accidents and Driver Education Pattern," Journal of Applied Psychology, 52 (1968) pp. 49-54.

Bamford, Harold E. "Human Factors in Man-Machine Systems," Human Factors, 1 (November, 1959), pp. 55-57.

Barrett, Gerald V. and Carl L. Thornton. "Relationship Between Perceptual Style and Driver Reaction to an Emergency Situation," Journal of Applied Psychology, 52 (1968), pp. 169-176.

Bartlett, Neil et al. "Recognition Time for Symbols in Peripheral Vision," Highway Research Board Bulletin 330 (January, 1962), pp. 87-91.

Bloomer, Richard. "Perceptual Defense and Vigilance and Driving Safety." Traffic Quarterly (October, 1962), pp. 549-558.

Bloomfield, Gary J. "Remember the Classroom." Safety (January-February, 1969), pp. 13-15.

Blumenthal, Murray. "Value Conflict, Decision Processes and Traffic Safety." Traffic Safety Research Review, 10, 3 (September, 1966), p. 89.

Brody, Leon. "Personal Characteristics of Chronic Violators and Accident Repeaters," Highway Research Board Bulletin 152 (1957).

Cozan, Lee W. "Engineering Psychology and the Highway Transportation System," American Psychologist, 16 (1961), p. 263.

Cushman, W. and Ray Wahl. "Driver Education - What it is - and What it Isn't." Traffic Safety (August, 1968), p. 18+.

Edwards, Ward. "We Drive as We Live." Analogy (Spring, 1968), pp. 20-22.

Forbes, T. W. "Human Factors in Highway Safety." Traffic Safety Research Review, 4, 1 (March, 1960), pp. 8-11.

Forbes, T. W. et al. "Measurement of Drivers Reactions to Tunnel Conditions," ARB Proc., 37 (1958), pp. 345-357.

Forbes, T. W. "Predicting Attention-Gaining Characteristics of Highway Traffic Signs: Measurement Technique," Human Factors, 6, 4 (August, 1964), pp. 371-375.

Forbes, T. W. "Traffic Engineers and Driver Behavior." Traffic Safety Research Review, 9, 3 (September, 1965), pp. 87-89.

Gibson, J. J. and Laurence E. Crooks. "A Theoretical Field Analysis of Automobile Driving." The American Journal of Psychology, 51, 3 (July, 1938), pp. 453-471.

Goldstein, Leon C. "Human Variables in Traffic Accidents: A Digest of Research." Highway Research Board Bibliography 31 (1962).

Goldstein, Leon C. "Psychological Aspects of Traffic Accidents." Traffic Digest and Review (July, 1964), pp. 10-12.

Greenshields, Bruce D. "Investigating Traffic Highway Events in Relation to Driver Actions." Traffic Quarterly (October, 1961), pp. 664-676.

Greenwood, Major and Hilda Woods. "The Incidence of Industrial Accidents with Special Reference to Multiple Accidents." Industrial Fatigue Research Board, Report No. 4, 1919.

Hickey, Albert E. and Wesley C. Blair. "Man as a Monitor," Human Factors, 1 (September, 1958), pp. 8-11.

Ittleson, W. H. "Size As a Cue to Distance: Static Localization." American Journal of Psychology, LXIV, 1 (January, 1951), pp. 54-67.

Lauer, A. R. "A Comparison of Group Paper and Pencil Tests with Certain Psychophysical Tests for Measuring Driver Aptitude for Army Personnel." Journal of Applied Psychology, 39 (1959), pp. 318-321.

Low, F. N. "The Peripheral Motion Acuity of 50 Subjects." American Journal of Physiology, 148 (1947), pp. 124-133.

Mann, William A. "Let's Talk it Over." Analogy, Charter Issue (1966), pp. 4-9.

McPherson, Kenard and Francis C. Kenel. "Perception of Traffic Hazards: A Comparative Study." Traffic Safety Research Review, 12, 2 (June, 1968), pp. 46-49.

Michaels, R. M. "Human Factors in Highway Safety." Traffic Quarterly (October, 1961), pp. 586-599.

Miller, Gene. "Accident Repeaters May Not Be Accident-Prone." National Safety News, LXVII (March, 1953), pp. 3-6.

Moseley, A. L. "Let's Train Drivers for that Last Crucial Moment." Traffic Safety (September, 1961), pp. 8-10.

Myrick, R. and L. E. Schlesinger. "Driver Improvement or System Improvement?" Traffic Quarterly (January, 1964), pp. 92-104.

________. "The NEA Has Its Say." Traffic Safety (December, 1968).

Olson, Paul et al. "Driver Judgments of Relative Car Velocities." Journal of Applied Psychology, 45, 3 (1961), pp. 161-164.

Payne, Donald and Joseph E. Barmack. "An Experimental Field Test of the Smith-Cummings-Sherman Driver Training System." Traffic Safety Research Review, 7 (March, 1963), pp. 10-14.

Perchonok, Kenneth and Paul M. Hurst. "Effect of Lane-Closure Signals Upon Driver Decision Making and Traffic Flow." Journal of Applied Psychology, 52, 5 (1968), pp. 410-413.

Platt, Fletcher. "Operations Analysis of Traffic Safety A Classification of Traffic Situations." Traffic Safety Research Review, 2, 4 (December, 1958), pp. 17-23.

________. "President's Committee on Traffic Safety Conference on Traffic Behavior Research." Behavioral Science, 3 (1958), pp. 347-355.

Quane, W. Laurance. "New Approach to Classroom Instruction." Safety (May-June, 1969), pp. 26-27.

Quensel, Warren P. "Teaching Visual Perception in Driver Education." ADEA News and Views, 3, 2, pp. 3-12.

Schlesinger, Lawrence. "Objectives, Methods, and Criterion Tests in Driver Training." Traffic Safety Research Review, 11, 1 (March, 1967), pp. 18-24.

Schlesinger, L. W. and M. A. Safren. "Perceptual Analysis of the Driving Task." Highway Research Board Record 84 (January, 1964), pp. 54-61.

Shaw, Lynnete. "The Practical Use of Projective Personality Test as Accident Predictors." Traffic Safety Research Review, 9, 2 (June, 1965), p. 34.

Smith, H. L. and J. J. Cummings. "Let's Teach Drivers How to See." Traffic Digest and Review, 4 (March, 1956), pp. 7-13.

Stephens, B. W. and R. M. Michaels. "Time Sharing Between Compensatory Tracking and Search and Recognition Tasks." Highway Research Board Record 55 (1963), pp. 1-16.

Stewart, Roger G. "Can Psychologists Measure Driving Attitudes?" Educational and Psychological Measurement, 18 (1958), pp. 63-73.

Turfboer, Robert. "Do People Really Drive as They Live?" Traffic Quarterly, 21, 1 (January, 1967), pp. 101-108.

Wright, Stuart and Robert B. Sleight. "Influence of Mental Set and Distance Judgment Aids on Following Distance." Highway Research Board Bulletin 30 (1962), pp. 52-59.

Publications of Organizations

Asher, J. William. Do Driver Training Courses Produce Better Drivers An Alternative Hypothesis. Purdue University, undated.

Brody, Leon. Personal Factors in Safe Operation of Motor Vehicles. New York: New York University Center for Safety Education, 1941.

Burg, Albert. An Investigation of Some Relationship Between Dynamic Visual Acuity, Static Visual Acuity and Driving Record. Report #64-18. Department of English, University of California, April, 1964.

Christner, Charlotte A. and Horace W. Ray. Final Report on Human Factors in Highway Traffic: Intervehicular Communication to Bureau of Public Roads. Columbus, Ohio: Battelle Memorial Institute, 1961.

________. A Commentary on Recent Reports Relating to Driver Education Research. Washington: National Commission on Safety Education, June, 1968.

________. The Environment and Man, Research Through 1966. Hartford, Connecticut: The Travelers Research Center, Inc., January, 1967.

________. The Federal Role in Highway Safety. 86th Congress, 1st Session, House Document #93.

Fox, B. H. Alcohol and Traffic Safety, Chapter 8. U. S. Public Health Service Publication, No. 1043.

Goeller, B. F. Modeling the Traffic-Safety System. Santa Monica, California: Rand Corporation, April, 1968.

Goldstein, L. C. Research on Human Variables in Safe Motor Vehicle Operation; A Correlational Summary of Predictor Variables and Criterion Measures. The Driver Behavior Research Project, George Washington University, June, 1961.

________. Highway Safety Program Management. Washington, D. C.: Automotive Safety Foundation, August, 1968.

________. Highway Safety Program Manual, Transmittal 11. Washington, D. C.: National Highway Bureau, January 17, 1969.

________. The Introduction, Rationale, and Basic Outline for the Revised Program of Instruction, Department of Safety Education. Springfield, Illinois: Office of the Superintendent of Public Instruction, April 25, 1969.

Lybrand, William A. et al. A Study on Evaluation of Driver Education. The American University, July 31, 1968.

________. Policies and Practices for Driver and Traffic Safety Education. Washington, D. C.: National Commission on Safety Education, 1964.

________. Report of the Secretary's Advisory Committee on Traffic Safety. Washington, D. C.: U. S. Department of Health, Education, and Welfare, February 29, 1968.

Ross, H. Laurence. Schematic Analysis of the Driving Situation. Evanston, Illinois: Traffic Institute, Northwestern University, 1960.

Safren and Schlesinger. Driving Skill and Its Measurement. Washington, D. C.: George Washington University, April, 1964.

________. School and College Safety, National Safety Congress Transactions, Vol. 23. Chicago: National Safety Council, 1968.

Senders, et al. An Investigation of Automobile Driver Information Processing, Final Report. Washington, D. C.: The Bureau of Public Roads, April, 1966.

Spicer, Robert A. Human Factors in Traffic Accidents, Research Grant No. AC-55. Washington, D. C.: Department of Health, Education, and Welfare.

Stack, Herbert J. History of Driver Education in the United States. Washington, D. C.: National Commission on Safety Education, 1966.

Speeches

Adams, James R. and Sanford Weinstein. Measurement Judgment of Impending Hazard by a Stimulus Acceleration Technique. A synopsis of paper presented at the annual meeting of the Highway Research Board, National Academy of Sciences, January, 1965.

Mann, William. Building Attitudes for Safety. Presented at the National Safety Congress, 1960.

McGuire, Frederick L. Personal Factors in Highway Accidents A Study in Prediction and Methodology. A Progress Report on the Mississippi Project. Presented at the National Safety Congress, 1967.

Pepyne, Edward. Changing Driver Attitudes. Presented at the Driver Education section of the MEA Regional Conference at Ann Arbor, 1956.

Platt, Fletcher et al. A Basic Plan for a Highway Transportation Systems Study. Prepared for the Fifth World Meeting of International Road Federation, September, 1966.

Platt, Fletcher. A Unique Method of Measuring Road, Traffic, Vehicle and Driver Characteristics. Presented at the IV World Meeting of International Road Federation, October, 1962.

Unpublished Materials

Cobb, P. W. "Automobile Driver Tests Administered to 3,663 Persons in Connecticut, 1936-37, and the Relation of the Test Scores to the Accident Sustained." Washington, D. C.: Highway Research Board, 1939, unpublished.

________. "Description of the Driving Task." Illinois State University, undated.

Robinson, Allen. "The Influence of Programmed Instructional Films on Perception of Traffic Hazards." Unpublished Master's thesis, Illinois State University, Normal, June, 1968.

Streeter, Gerald M. "A Classroom Visual Perception Program for Beginning Motorists." Unpublished Master's thesis, Illinois State University, Normal, August, 1968.