"I DIDN'T SEE HIM" by Conrad E. Mazeski, O.D.

Editor's Comment:

The following article appeared in the 1976 April issue of the "Journal of Traffic Safety Education". Although the article is old, the information it supplies is still valid. It also provides some good insights into some of the problems we may encounter in our handicapped population. Since the most important way information is taken in while driving is visually, it seemed worthwhile to reprint the article here.

"To what extent is vision involved in traffic accidents and to what extent is the visual status of the driver responsible for them? Analysis of accidents to determine the role played by the measurable aspects of vision such as visual acuity, color vision, and dark adaptation have been disappointing. The most reliable studies to date are those from the UCLA Institute of Transportation and Traffic Engineering in cooperation with the California DMV. Studies by Burg report:

"Among the vision variables studied, dynamic visual acuity shows the strongest and most consistent relationship with driving record. There is substantial but not conclusive evidence that static visual acuity, glare recovery, and visual field also are related to driving record. The data suggests differential vision driving
relationship as a function of age. However, at the present stage of analysis, the precise nature and extent of these differential relationships as a function of age cannot be determined.

Alcohol is responsible for a large number of fatal accidents. (Haddon, et al., 1964) Other hazards to safe driving such as carbon monoxide, tranquilizers, and antihistamines also act in part to destroy visual acuitness, visual-motor coordination, and perceptual alertness. Any compensitable visual anomaly becomes progressively less compensitable under the influence of these agents. Darkness alone, for example, reduces the ability to fuse, to accommodate, and, for squinters, to suppress. In addition, reaction time is increased, space judgments are altered, and alertness is reduced. One could expect that heavy smokers, all of whom show measurably higher levels of carbon monoxide in their blood, will have more asthenopia (eye strain with dimming of vision) and more accommodative problems than persons not exposed to carbon monoxide. The harmful effects of carbon monoxide on driving are at least aggravated by alcohol, darkness, and fatigue.

The magnitude of visual problems in America has been indicated in several studies. Glaucoma exists in 2% of all persons over the age of 40; stabisus exists in from 2-7% of the population; 8% have some form of color vision anomaly; 17% have anisocoria (unequal pupil size) to an extent which may be hazardous; and 4% have ambylopia at grade school levels. Twenty percent have visual anomalies sufficient to merit correction, and everyone by the age of 60 needs visual correction of some type.

Continuing to permit drivers with substandard vision to operate a vehicle because it is difficult to prove the need for superior vision draws a parallel with the practices in the automobile industry and elsewhere that are based on economics, expediency, or styling and not on vision. Take, for example, the windshield itself. Many of us experience glare off the windshield, or reflections, such as seeing double headlights if one is wearing glasses. If, according to Society of Automotive Engineers specification, a windshield loses 30% of the visible light at normal incidence, at an angle of 60 degrees, such a windshield will lose 39% of the visible light and 58% of the visible red light, which will make it more difficult to see the brake lights of a vehicle in front, or traffic lights. Reflections from windshield surfaces of objects inside the car are serious sources of signal-attenuating visual noise. The back of the windshield behaves like a mirror. Fortunately, the automobile industry has taken cognizance of the reflective surfaces, and is changing and hiding all highly polished chrome. This has been a big boon to reduction of reflections.

Driver Vision Requirements

The driver is the most important component in the driving task. With the number of decisions that must be made and the amount of information that has to be processed under heavy traffic conditions, safe performance can be expected only up to a point with increasing load. A person required to carry on an exciting conversation while driving may become perceptually overloaded at 20 miles per hour. The amount of visual noise, condition of the driver and his vehicle, the speed and traffic density, and the diversions facing the driver all
determine whether the driver is likely to lose safe control of his vehicle.

Let us consider the acuity factor. Many states show a 20/40 level as passing in a driver testing program. What does 20/40 mean? Good acuity, 20/20 or better, permits the detection of hazardous situations earlier and provides more time for study and action. An acuity of 20/10 would permit twice as much time to act as an acuity of 20/20. With 20/40, only one-fourth as much time would be available compared to excellent 20/10 acuity. Although visual acuity is most easily measured, it is a very complex function which is poorly understood. It is inextricably interrelated with contrast, illumination and exposure duration. If any of the three is reduced, the larger test letter size is needed.

The importance of peripheral vision to driving can be appreciated from the following: At 60 m.p.h. we cover 88 feet of highway per second. With 0.25 second fixations we can inspect the road foveally only at points every 22 feet. The remainder of the scene with its many details and spatial relationships must be sensed by peripheral vision. Without peripheral vision to keep us informed of the big picture, we would be badly handicapped even for walking around in our own home. Normally, peripheral vision is good, but not perfect. Good peripheral vision allows a maximum of information with a minimum of eye movement. This increased perceptual efficiency allows more time for decision and action by the driver.

A number of factors go along with visual acuity. Dark adaptation is the ability of the eyes to increase their sensitivity so that tiny amounts of light are effective in causing visual responses. On an average, it takes five minutes to recover from bright light to dim light. On a busily traveled highway we don't have five minutes between vehicles. Older drivers with small pupils and/or incipient cataracts have reduced ocular transmission to maybe one-fifth to one-twentieth of normal. So it would take that much longer to recover. Testing for impaired ability to see at night should be done routinely. A test with low luminence background, such as a night vision performance test, would give an incident indication of the person's ability to perform at low luminosity levels.

Glare resistance is the ability to recognize useful information in a visual display in the presence of bright light. At night on the highway, the driver faces approaching headlights at the same time he is required to see the roadway details well enough to avoid hazards. It is common experience that glare resistance becomes significantly greater when a lens correction is supplied to eliminate refractive errors. At night, of course, the ability to see the roadway may be severely impaired if glare resistance is low. Interestingly, the average auto windshield has so much stray light due to scratches, pits, internal reflections, and dirt, both in daytime and at night, that the driving glare resistance of even the most glare resistant individual may be inadequate to permit safe operation.

Another factor which is totally ignored in driver tests is ocular muscle imbalance. It is probably the most important contributor to driver
visual inefficiency. In, out, or upturning tendencies (eso-, exo-, or hyperphorias) are usually more or less easily compensated for by a driver at normal daytime illumination, although the effort to compensate may take its toll in fatigue or discomfort. At night, a little imbalance may become unmanageable, particularly if the driver is fatigued, overfed, or drugged by alcohol, carbon monoxide, or medications. Double vision of sudden onset can be catastrophic, especially to an inexperienced driver. The difficulty occurs because of the reduced illumination. Fusion is lost; the eyes have nothing to look onto, and double vision may result. Yet the individual may have 20/20 acuity. Darkness tends to cause a focusing in-turning of the eyes to about the plane of the windshield, even in normal eyes. In many situations, windshield dirt or water can be a stronger fusion stimulus than the highway itself. Certainly a test for hyperopia and muscle balance should be a mandatory part in the driver license eye test, and should be done under reduced illumination.

Night driving can also be a cause of what is known as night myopia. The individual loses the ability to see clearly and performs as though near-sighted because of lack of fusional ability. Further compounding this problem is another factor neglected in testing of driver vision - the motility of the eyes. Can the eyes move efficiently and accurately from one point in space to another with reduced illumination? Motility may be severely impaired. Eye surgery that originally was used to correct an overconvergence (turning in) or under-convergence (turning out) of the eyes may impair ocular motility. Such people should be studied carefully to see whether they can be helped in driving safely at night.

Another visual problem which affects driving is squinting, where the eye turns in or out. Between two and seven percent of the people have this particular problem. Most squint treatment by surgery is intended to achieve at least a cosmetic cure, which is successful in about 80% of the patients. But that is a cosmetic cure and the deviation from cosmetically-appearing eyes still may be in the range of 15 degrees of either overconvergence or under-convergence. A condition known as anisocoria in which one pupil is significantly larger than the other affects about 17 percent of the U.S. population. A difference in pupil size will cause a difference in retinal illumination, which results in a stereoscopic error for moving targets. The stereoscopic effect can be produced also by glare entering one eye such as from an oncoming automobile. The size of the image seen while driving could lead to collision situations. If the eye has reduced illumination in the left eye, this will cause an automobile moving to the right across the highway to be seen as farther away. If it is moving to the left it will appear to be closer. This is quite dangerous on narrow, winding roads. You can experience this effect experimentally by driving around the neighborhood while wearing dark sunglasses from which one lens has been removed.
Vision Screening Possible

As you can see, the standard vision screening tests employed by either the state DMV or the schools do not cover these particular areas so important for safe driving. There are some techniques that the driver education teacher can apply. Let's see what can be done with materials that are not costly. First of all, observe your students' pupil size. You may use a millimeter rule and measure it, and then with practice you can get pretty good, so that you do not need a ruler and you can tell whether the pupils are the same size. A one millimeter difference in size may cause a problem in stereoscopic depth perception. Definitely a two millimeter difference will provide difficulties. Check for alignment of the two eyes. This may be done with very simple equipment also, using a red-green lens and red and green flashlights from Barnell Manufacturing Company. The purpose of the red-green is to determine whether both eyes are being used, to determine the angle of squint, and whether there is a vertical or a horizontal deviation. Another test that is quite good and easy to perform is a test known as the "Stereo Fly" test, using polaroid lenses for determination of depth perception.

A string ten feet in length will provide you with a great deal of information. One end of the string is secured to a nail or a hook on the wall at about eye level. The other end of the string is positioned on the student's nose. The student is instructed to look at the hook on the wall to which the string is attached. He should see two strings coming from each side to the point of fixation - the hook. If only one string is seen, the question is asked: "Which side does it appear to come from?" If the response is "from my left ear," that indicates his right eye is working, because the string is to the left of that eye. The left eye is not being used; this is known as suppression. The student may also indicate that the two strings are there, but come and go. They may both be present only at times. This type of situation definitely causes errors in distance judgment while driving. The student should be referred to his optometrist for assistance. Lenses may be necessary, and/or visual training.

Still using the string, you may determine whether the individual's eyes are turning in or out by having him fixate at the point where the string is attached to the hook. He may tell you that two strings meet in front of the point. If so, his eyes are turning in. With the eyes fixating at a point in space closer than the target really is, he has a false sense of security and thinks the object is really further away than it really is. You can anticipate situations such as tail-gating or sudden stops.

You also have a situation where the eyes turn out. Those individuals have a very difficult time seeing at twilight or in foggy conditions. Another common concern is the individual who has night blindness. These people have normally 20/20 acuity during the daytime but fall very short during nighttime driving. This may be due to a decrease or deficiency of Vitamin A within their system,
From the Pres-Elect

CHANGE IN CONFERENCE FEES SET AT
BOARD MEETING APRIL 30TH 1984

A significant change was voted at the Executive Board Meeting in Ann Arbor, Michigan on April 30th. Conference fees were established which will give a member a slight break. Active, associate and retired members can register in advance for $50.00 for the 1984 Conference which will be held in Philadelphia, Pa. September 19-21, 1984. Late registrations of 1984 members and all registrations for non-members will be $65.00. All 1984 members are encouraged to send in their dues for their 1985 dues with their conference registrations. All memberships expire September 30th each year. Employees of agencies or corporations that are 1984 members can register in advance at the lower rate.

CHUCK LEACH who was employed as a Driving Instructor at the Center for Independent Living in Grand Island, Nebraska was recently promoted to Director of the program. Congratulations Chuck!

DEAN NODLER has taken over the position of Director of the Driver Training Program at Bryn Mawr Rehabilitation Hospital in Pennsylvania. Good luck Dean.

LEROY ROTSCHAFER well known to all of us as this year's President has also found time in his busy schedule to speak to the Iowa Association of Safety Education on "The Identification, Instruction and Evaluation of our Special Population". Much impressed with a similar program presented in Toronto as part of the 1983 ADED Conference, Leroy organized a "Roadeo" of handicapped drivers in Des Moines. A successful and fun event for all.

NOTEWORTHY!

EUREKA DRIVING AIDS is now in operation serving four rural counties in Eureka, California. In addition to the sales, installation and service of driving aids, Eureka also has a driving school to handle behind-the-wheel training.

JOAN ARNOLD-DRENER has taken a position with the Driver Education Center of Memorial Hospital in South Bend, Indiana. Ms. Arnold-Drener who is a registered OT will be developing a program specially tailored to the developmentally delayed student. Good luck in your new position and WELCOME TO ADED.

WANTED:

Someone to share room at Adam's Mark during conference dates. Contact during day:

Carole Robertson
(804) 254-6161
What are YOU doing?

I would like to know so it can be publicized in the newsletter. This is a good way of letting other ADED members know what is going on in the organization. It also provides information on where and what kind of expertise is available within ADED.

Just check the appropriate block/s, detach this page, fold and mail.

1. _______ Been promoted?
2. _______ Started a new program or expanded an old one?
3. _______ Been asked to speak or present a paper at a convention, workshop or convention?
4. _______ Received funds for a research project?

Brief Explanation: ________________________________________________________________
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Look for your entry under "NOTEWORTHY" column

NAME: ......................................................................................................................

ORGANIZATION: ....................................................................................................

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