

*COMPUTER PROGRAMS FOR COGNITIVE REHABILITATION -*

# **Resource Manual:**

# Elemental Driving Simulator (EDS)

**&**

# **DRIVING ADVISEMENT SEMINAR**

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## Acknowledgments

The EDS was derived from the Driving Advisement System (DAS). My initial inspiration grew out of an analysis of the cognitive demands of driving which emerged from a brainstorming session held at Louisiana Technical University Rehabilitation Engineering Center for Personal Licensed Vehicles in January 1986. Changes in the world of computing have forced a major hardware and software re-design. These changes have been implemented on the EDS; while the DAS goes into retirement.

Psychometric evaluation of the DAS and EDS, without which these procedures could not legitimately be used to guide decisions about driving, was conducted through a collaboration with Occupational Therapist Amy Campbell, OTR/L, CDRS, formerly of The Mobility Center, Meriden, CT, and Gaylord Hospital in Wallingford, Connecticut. I am deeply appreciative of Amy's interest, expertise and special efforts. All users of the DAS and EDS are beholden to Amy.

Further psychometric evaluation of the EDS with older drivers was conducted by Virginia Delibero, MS, OTR/L as part of a master's thesis at the Touro School of Health Sciences. Her findings were so powerful that we modified the EDS to include the Driver Self Report (When) items in 6/95. Ginger's energy and her findings are a significant addition to the EDS.

The yeoman efforts of programmer Aaron Beattie are subject to the iceberg principle: for every bit you see, an incredible bulk lies below the surface. The precision and accuracy of this instrument are attributable to his expertise and care.

Dr. Frank Mandriota of Life Science Associates has contributed particularly to the engineering and production of the hardware, as well as to coordinating distribution of the entire system.

Thank you all.

Rosamond Gianutsos

Sunnyside, NY November 2004

# Driving Advisement Seminar: Resource Manual

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# Driving Advisement Training Seminar

The purpose of the training seminar is to assure that the Driving Advisement protocol, Elemental Driving Simulator (EDS) is appropriately and consistently implemented. This level of concern with the way these materials are used is dictated by the seriousness of the decisions which have to be made: While driving is often a key to independence for an individual struggling to overcome disabling conditions, the safety of the other inhabitants of the roadways is also at stake.

## **Focus on EDS**

The EDS has been developed and tested on cognitively at-risk persons who would resume driving after a brain injury, as well as able-bodied community residing older persons who would continue driving. For those familiar with its precursor, the Driving Advisement System (DAS), the EDS has several new features and research validation data which substantiates its use.

- ◆ Brief testing time
- ◆ Increased realism (Turn signal replaces 'Brake' and 'Horn')
- ◆ Personal report designed for the patient to take home. This promotes understanding, retention and dissemination of findings with family members and other concerned persons.
- ◆ Incorporates true simultaneity into the simulation task.
- ◆ Simpler to use and interpret.
- ◆ Feedback during practice to motivate and inform the patient.
- ◆ Brief printout: 1 page technical report and 1 page personal report.
- ◆ Deferred printing: Test now, print later. Great for printing an additional report for the patient. Also saves you from losing reports if your printer jams.

**A truly portable EDS** is now possible with advances in laptop technology and the archive data / report printing (REPORTPT) capability. The EDS Portable Wheel and pedals make the EDS hardware relatively easy to carry around.

## Specific Understandings

Upon satisfactory completion of the training seminar, individuals will be given a statement certifying their completion of the seminar and entitling them to use LSA's Driving Advisement materials. If they have purchased the materials, they will receive a copy of the software which identifies them as professionally responsible for its use. The EDS materials are supplied only with the names of professionals who have established their qualifications and completed the seminar.

The Driving Advisement seminar focuses on use of the EDS. Persons who have already had the seminar for the DAS are not required to repeat the training when obtaining the EDS. However, former Driving Advisement students are always welcome to attend the seminar again without charge because their input is usually helpful to the first-time students.

The right to use LSA's Driving Advisement software (EDS and DAS) may NOT be transferred to others. If an institution sponsors an employee to receive the training, and that employee leaves the institution, the institution will have to sponsor someone else to receive the training through Life Science Associates. Being trained and experienced in the use of these procedures is not sufficient to train others. Under some circumstances, certified DAS/EDS examiners may delegate administration of tasks to a subordinate, provided that the certified examiner remains sufficiently aware of the situation to accept full professional and legal responsibility for the outcome, recommendations and report. Delegation of responsibility for the Driving Advisement procedures is not encouraged and is limited to administration of tasks, not interpretation of findings or clinical case management.

Driving Advisement seminars are conducted only by trainers who have been authorized by Life Science Associates.

## Learning Objectives for the Seminar

1. Students will recognize appropriate use of EDS protocols, including indications for their use.
2. Students will demonstrate appropriate operation of EDS hardware and software.
3. Students will administer the full EDS assessment protocol.
4. Students will interpret data and results, apply them to patient's needs and explain them clearly.
5. Students will know their legal responsibilities, including obtaining consent with a clear statement concerning the disposition of findings.
6. Students will show ability to prepare reports, including the integration of raw data into a reporting format and clinically effective ways to formulate conclusions and recommendations.
7. Students will be able to articulate the purposes and the limitations of off-road driving advisement. They will be able to identify resources in the local and broader professional community to assist them in the driving advisement process.

## Local Resources for On-the-Road Testing

Consider private sources, e.g., local driving schools, as well as public (if any).

1. Are there specialized services for drivers with disabilities?
2. How much experience do they have with brain-injured drivers and drivers with disabilities?

## Information on Local Laws and Regulations

Prior to the seminar, each participant is to obtain information concerning legislation and regulations pertaining to the licensure of drivers following an injury or the onset of any other condition which affects the functioning of the brain. Please verify this information with your licensing authority.

1. Is licensure conditional on maintenance of health and mental function?

If so, who is responsible for notifying the licensing authorities of any change in status? Specifically, is there mandatory reporting by professionals? by the driver?

When is this to be done?

What are the consequences of failure to notify?

If a professional feels obliged to report a patient to the licensing authorities, is the professional vulnerable to a lawsuit from the patient for violation of confidentiality? Or, does the law provide immunity for concerned providers who notify the authorities.

Can an individual report a potentially unsafe driver anonymously?

2. What provisions exist for routine re-evaluation?

Upon renewal of licensure, is vision re-examined?

After a certain age, is re-evaluation required?

3. Does the licensing authority offer any specialized services for disabled drivers, e.g., evaluation and re-training? non-driver identification cards? vouchers for alternative transportation?

4. What are the policies pertaining to seizure disorders?

5. What are the requirements for vision, i.e., acuity, visual field, binocular vision?

6. What differences in the above policies and procedures apply to drivers of trucks, school buses, vehicles for hire, etc.?

Note: It is suggested that you prepare a statement on your local DMV laws and procedures, see, e.g., the statement "What Happens to your New York State Drivers License ..." in a later section of this manual.

## Seminar Preparations

The seminar requires at least 9 hours, usually a full, uninterrupted day (8:00 AM to 5:00 PM) .needed. This time is necessary to address the issues of driving advisement and the use of the EDS. If you have purchased the PERFIELD (Functional Visual Fields / Peripheral), you may request and schedule up to 2 additional hours for each of these packages. These additional hours are optional and without additional charge, if scheduled at the time of the seminar.

If there is more than one trainee, the seminar will be conducted in the trainees' facility. In that instance, the host assumes responsibility for the trainer's full travel expenses . In addition to arranging for the trainer's travel and computers, hosts will provide a suitable seminar room with tables, chairs, and electrical outlets. It will be helpful to have access to a computer with printer for printing of reports.

# Driving Advisement Seminar: Topic Outline

## I. Rationale

- A. Advisement, not just assessment
- B. Cognitive aspects specifically introduced into the EDS
  1. Judgment / self-appraisal
  2. Simultaneous information processing
  3. Efficiency of complex information processing
  4. Autoregulation / impulse control
  5. Ability to perform consistently
  6. Frustration tolerance
  7. Pedal control
  8. Eye-hand coordination, praxis

## II. Preliminaries

- A. Hardware
  1. Setup & check-out
  2. Trouble-shooting and simple repair
  3. Adaptive inputs
- B. Software - installation procedures
- C. Patient preparation
  1. *Background Information* form - including medications
  2. Status of licensure
  3. Eye glasses - bring READING glasses
- D. Advisement re legal status (*A Word to Survivors ...*, *Memo of Understanding*)

## III. Conduct of procedures

- A. On self
- B. On other neurologically-intact safe drivers (at least one!)
- C. On an uncomplicated patient
- D. How to run individual tasks
- E. REPORTPT - Archiving and printing reports later

## IV. Interpretation of Results and Preparation of reports

- A. EDS "Personal Report"
  1. Norm-referenced scaled scoring system
  2. Definition of measures
- B. EDS "Data Sheet"
  1. Measures of steering: Standard Deviation and Wobble
  2. Measures of response time: Mean, median and standard deviation
  3. Cutoffs and decision-making
- C. DAS reports
- D. Formulation of conclusions and recommendations
- E. Professional responsibility for reports: what, if anything can be delegated to others?

## V. Follow-up and follow through

- A. The Driving Advisement procedures in the context of a rehabilitation team
- B. Communicating with the individual and concerned others in a clinically effective manner
- C. Some rehabilitative strategies
  1. On-road testing - liaison and follow-up
  2. Active passenger technique
  3. Defensive driving courses
  4. Addressing mobility needs, including involvement of others
  5. Counseling

## VI. Research findings

- A. Norms
- B. DAS findings
- C. EDS findings

# Installation and File Management

## A. Hardware .....

### Included components:

#### Steering wheel assembly -

- The steering wheel includes the turn signal, a cable with a USB plug and USB to PS2 adapter, and three sockets. The wand for the turn signal may be unscrewed for transport, although this is usually not necessary. The base of the steering wheel assembly is articulated, allowing it to be elevated (propped up on a phone book, exercise weights, etc.) so that the laptop screen can be raised and brought to a comfortable reading distance. .

#### Three pedal foot switch assembly -

- This unit has a cable with three (mini phone) plugs which correspond to **Left turn signal**, **Gas**, and **Right turn signal**, respectively. These are plugged in to the sockets on the Steering wheel assembly. In circumstances where you do not plan to test pedal response, you may substitute a simple remote control pedal (not supplied) for the **Gas**. This makes your system even more portable.

#### Laptop computer -

- The laptop is a refurbished and reconfigured IBM Thinkpad T20 or equivalent. This system was selected because of its quality and durability. It is the choice of businesses, for whom reliability is paramount. You may access documentation through Windows or from the manufacturer on the Internet.
- Your system has been configured to boot to an MS DOS menu, from which you may elect to load the Windows 98 operating system. You will use the MS DOS menu to run all tests. From Windows you can perform file management, including report printing, access documentation and additional software.
- **Powering on and off:** The power button is on the front center of the console. If in MS DOS (Direct Access menu) mode you may simply turn the computer off by pressing this switch. If in Windows, you should exit Windows first, before powering off. For your convenience there is an icon "Shut Down Computer" on the desktop. Alternatively, click on the START menu and select Shut down computer. If your computer "freezes" in Windows, first try <CTRL> + <ALT> + <DELETE>. If all else fails, hold the power button down from 5 to 10 sec. and the computer will give up the ghost. When you re-enter Windows, it will run Scan Disk - which serves little purpose other than to punish you for turning off the computer without putting Windows to bed properly first.
- The keyboard has a **blue <FN> function key** which is used in combination with some of the function keys, e.g., <FN> + <F4> suspends the computer - handy if you are in the middle of a project to which you will return in a few hours and don't want to shut down and reboot the computer. This works about 75% of the time (on this and most other computers), so don't trust it completely. <FN>+ <F12> is supposed to hibernate your computer, which is a long-term suspension. Why would you do this instead of shutting the computer down completely? (Ans. big projects, many open windows - maybe). If you are using your computer to do a presentation, you will need to use the <FN>+<F7> combination to re-direct the output to the projection device, or external monitor.
- <FN>+<HOME> and <FN>+<END> are used to increase and decrease the display contrast.
- At the top of the keyboard are buttons to decrease, increase and mute the **sound**
- The **mouse functions** on the laptop are through the "eraserhead" in the middle of the keyboard. This device may take some getting used to. Occasionally, the cursor seems to float on, even when you take your finger off the eraserhead. Don't fight with it. Just let it float until it rests, then move the cursor back to where you want it. The buttons with red lines at your thumbs are the primary and secondary mouse buttons. The larger blue lined button closest to you controls the third mouse button, usually with scroll lock functions. If you try running the EDS without the steering wheel and

pedals, you will find that you can use the eraserhead to steer, the primary and secondary buttons for left and right signals and the large blue button for the gas.

- **Internet access:** Your system comes with a built in modem and ethernet socket from which you can access the Internet. Caution, however, is advised. Remember, your computer can not get a virus if you are not connected to the web and do not load software and files from other computers. That said, your system has plenty of space for pictures and other programs.
- **Open Office:** Supplied on your computer is an office suite of applications including word processing, spreadsheet, presentation system. This software is compatible with Microsoft Office applications, i.e., you can read and write in Office formats (although Open Office defaults to its own formats). If you have Microsoft Office, you may wish to uninstall Open Office and then install Microsoft Office. Open Office is supplied as a courtesy: it is not supported by Life Science Associates. You can access help on Open Office on the Internet.
- The laptop is ordinarily supplied with a **CD drive**, most of which seem to play DVDs. There is **no floppy disk drive**, although you may request a floppy instead of the CD/DVD drive. Instead, we include a flash memory drive (see below) which has the capacity of approximately 20 floppy disks.
- Your laptop also has room for **2 PCMCIA cards**. These are handy for receiving different types of memory cards (as from your digital camera).
- **Sockets at the rear of the laptop** include: PS2 (mouse, external keyboard), USB, power, ethernet, modem, VGA out (external monitor, projection screen - you will need to redirect the display by holding <FN> and pressing <F7> to toggle from laptop to external to both), parallel printer, 9 pin serial, and S-video (TV). On the left front are microphone, line in and earphone sockets.
- **Maintenance:** Treat your laptop with respect and you will have a long and happy relationship with it. The screen is the most expensive and vulnerable component. Don't step on it, squeeze it, or stuff it into a suitcase. Laptops, like all computers, do not like to be overheated. Be sure it has room to breathe. You may clean the screen gently with window cleaner. Avoid spills, crumbs, ashes and other debris.
- For the first year, the laptop will be serviced or replaced by Life Science Associates under the warranty - provided it has not been dropped (e.g., cracked screen), damaged by spills (water damage), etc. Following that period of time, it is advisable to purchase from LSA an extended service contract (not including the battery) for \$200/year (or \$500. for 3 years beyond the warranty year). Replacement of the laptop with originally installed software costs \$1000. plus \$50. S&H.

#### **Power adapter for laptop -**

- It is strongly recommended that you use the power adapter when conducting tests. The laptop's Lithium Ion battery, as supplied, will hold a charge for at least an hour, but you can not expect this capacity to be maintained over the life of the laptop. The battery should be regarded as a backup in the event of power variations or interruptions during testing. New replacement batteries can be purchased on internet auction sites, e.g., e-bay, for under \$100.
- The AC cord for the power adapter is usually detachable (presumably to allow alternate plugs for international use). Occasionally, it will be loose or unplugged and this would be the first thing to check if your computer is losing power. Additional power adapters can be purchased on internet auction sites for about \$30. - a convenience if you are moving regularly to a secondary location.

#### **Flash memory "drive" -**

- This small "gizmo" plugs into the USB socket. It will be recognized from Windows as an additional (usually E:) drive. It is pre-loaded with the Report printing software, so that when you copy report files from the laptop's hard drive (C:) to E:, you can then take the flash memory drive to an office computer and run the REPORTPT program to print, move, etc. the files on that second computer. If the second computer does not automatically recognize the flash memory drive, you may have to install appropriate drivers. If you wish to print from the laptop, you will have to install the printer drivers, following the instructions that come with the printer.

**Set-up.** Plug in the AC power adapter into the wall and into the computer. Plug the steering wheel assembly USB / PS2 cord into the PS2 socket at the back of the computer. Plug the pedals into the sockets on the steering wheel assembly. Power on the computer and you will get to the Direct Access menu.

**Adjusting Wheel Tension.** The turning tension of the wheel can be changed by loosening or tightening the screw in the hub of the steering assembly.

**Adjusting Pedal Force and De-bounce.** A length of foam tubing is supplied from which "doughnuts" of different thicknesses can be cut with a razor blade or scissors. The doughnuts can be placed around the red pedal buttons to correct bounce problems or to increase the force required to close the switch.

## **B. Software .....**

*All software is pre-installed on your computer. In the event of failure, we will attempt to resolve the problem over the phone. However, you may have to return the unit for restoration of the original software.*

*NB: it is prudent to copy your data files onto another computer for back-up purposes. This process is most conveniently accomplished in the course of copying (not moving) your files onto flash memory for subsequent printing.*

## **Operating system: MS DOS and Windows 98 .....**

**Windows and the EDS** are not at all compatible. This is because Windows is inherently a time sharing / multitasking system and it does not give precise and accurate times. (Did you ever wonder why the fast-paced arcade games are almost all DOS based?)

**More "good" news:** Manufacturers of printers have been making cheaper models which must be run under Windows. If you have this kind of printer, you will not be able to print directly from the EDS or from the Direct Access (boot up) menu. You should archive your printout and later run REPORTPT from the icon on the Windows desktop. This procedure is preferred also because the printout will appear neater.

## **Running the programs .....**

The system boots to a "Direct Access" menu which includes the following options:

- EDS** - to run EDS
- PERFIELD** - to run the Functional Visual Fields (Peripheral) programs, if purchased.
- REPORTS** - to view and print archived EDS, PERFIELD and other COGREHAB files
- TEST EQUIPMENT** - to test steering, turn signal and pedals
- WINDOWS**

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**REPORTPT and archive reports** feature: When the EDS procedures are completed, you will be given the option to defer printing. We recommend that you take this option. This option is handy if you are running the EDS on location and you do not have a printer connected. If you select deferred printing, the program automatically saves the reports in a file in a subdirectory: **\LSA\COGDAT\PRINTOUT**. If you elect to print the EDS reports immediately, you will then be asked if you would like to archive (save) the reports in a disk file. The advantage of doing this is that you can view and reprint the reports again later. If your printer is performing poorly, has jammed, etc, be sure to archive the report file so you can print it later when the printer is fixed.

**How to retrieve and print archived EDS reports:** Start the REPORTPT program by typing REPORTPT where you would otherwise type (or select) the EDS. If you are running from a hard disk, the program will assume that your reports have been stored on the hard disk. If they are on flash media, be sure the device is plugged in and move the highlight to indicate which drive contains the data. Following the instructions on the screen, you should see a list of available reports. They will give the patient's name and date on which the test was run. Highlight the one you want to work with. As indicated at the bottom of the screen, press **V** (view), **C** (copy), **M** (move), **P** (print), or **D** (delete). Press **ESC** when you are finished. You can press **S** to sort the files by task, patient, and date.

You will note that for each administration there are two entries, one for practice data and self appraisal information and one for the EDS test runs. There may be times when you will have to rely on the Practice and Self-Appraisal data, as the person was so overwhelmed by the task that the only meaningful data comes from the person's inability to benefit from practice.

## Technical Information regarding Data Management

Save this section for future reference. You may never need it. Skip the next two pages.

### Location of Data Files:

Data are stored in the subdirectory LSA\COGDAT, should you wish to examine them directly with a file management, text editor or word processing program. The cumulative data files are denoted by the name: **eds.cum**. The archived individual printouts are located in the **printout** subdirectory of **lsa/cogdat**. They are named **edsymmdd.iis** where *y* = last digit in the year, *mm* = month, *dd* = day, *ii* = patient's initials, and *s* = sequence (in case the same person did it more than once in a day). Practice data are denoted similarly, except that they are named **edpymmdd.iis**.

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**Data files** may be examined directly with a file management, text editor or word processing program. If you save your file from such a program, be sure to re-name the file (use Save As), so that you do not over-write (i.e., erase) your raw data files. A good precaution is to save a backup copy of your raw data files and experiment with the copy.

Look for files in the LSA\COGDAT directory with the following file name extensions:

**\*.CUM** - cumulative data for EDS and other LSA (non-DAS) programs

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### To backup your raw data to a flash memory disk in drive E:

**(EDS) COPY C:\LSA\COGDAT\\*.CUM E:**  
**COPY C:\LSA\COGDAT\PRINTOUT\EDS\*. \* E:**

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**Warning: The rest of this section contains TECHNICAL INFORMATION WHICH YOU MAY NEVER NEED:**

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**EDS.PRM** are files located in \LSA\COG6, the same subdirectory as the main programs (EDS.EXE). They are text files, which means (unlike the program file) you can edit them to meet your own needs. They contain information on the date format (for use in English-speaking countries which put dots between the month, day and year and put the day before the month), miles or kilometers, and text of the recommendations.

EDS.PRM file contains, for example :

Line 1: 20  
Line 2: 10  
Line 3: .65  
Line 4: "DD.MM.YY" *date format in quotes*  
Line 5: "km." *abbreviation for mi. or km. in quotes,*  
Line 6: "printer setup string-specific to your computer" *in quotes*  
Line 7: RECOMMENDATIONS: *13 lines of text for end of report*  
Line 8:  
Line 9: \_\_\_ Not recommended at this time for driving  
Line 10:  
Line 11: \_\_\_ Complete driver evaluation, including on-road assessment  
Line 12:  
Line 13: Comment:  
Line 14:  
Line 15:  
Line 16:  
Line 17:  
Line 18:  
Line 19: \_\_\_\_\_

For convenience we have prepared model EDS.PRM files for different printers and to adjust for the different formats used in most English-speaking countries. Therefore, copy one of the following as DAS.PRM or EDS.PRM to configure for your country and printer. If they work (programs run fine, print looks nice), don't worry. If the print looks messy, you may have to get the codes from your printer manual. You would like to have 12 characters per inch, indented and with IBM graphics character set.

USHP4L.EDS	HP laser	US
NZHP4L.EDS	HP laser	metric
USOKILAS.EDS	Oki laser	US
NZOKILAS.EDS	Oki laser	metric
USOKIDOT.EDS	Oki 192	US
NZOKIDOT.EDS	Oki 192	metric
USPLAIN.EDS	Dot matrix	US
NZPLAIN.EDS	Dot matrix	metric

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**How to Extract EDS Data:**

1. EDS data are stored cumulatively in a file EDS.CUM in the location of the data files, e.g., LSA\COGDAT.
2. You may import EDS.CUM into an Excel spreadsheet in CSV format.

**Warranty.** The EDS system hardware and software is warranted for one year from the date of purchase. Defective units or components will be repaired or replaced at no cost, including parts and labor. No other warranties are expressed or implied. Adjustment or repair arrangements should be made by telephone, FAX, or letter prior to any returns.

For the first year, the **laptop** will be serviced or replaced by Life Science Associates under the warranty - provided it has not been dropped (e.g., cracked screen), damaged by spills (water damage), etc. Following that period of time, it is advisable to purchase from LSA an extended service contract (not including the battery) for \$200/year (or \$500. for 3 years beyond the warranty year). Replacement of the laptop with originally installed software costs \$1000. plus \$50. S&H.

**Problems?** Some problems can be resolved by a telephone call, so please contact LSA at the first sign of difficulty at  
**631 472-2111, FAX 631 472-8146. or e-mail: lifesciassoc@pipeline.com.**

# Rationale and Background for Driving Advisement

## INTRODUCTION

(See pp. 70-74 of the Gianutsos, et. al. *Assistive Technology* article.)

### Purpose of Driving Advisement

The purpose of predriving assessment of cognitive abilities is to offer feedback and information to individuals and their associates (family, therapists, doctors, etc.) without imposing risks on others. Since on-the-road assessment is costly and there is a certain amount of risk, it is better to identify those individuals who are not even close to eligibility through off-the-road procedures.

Under some circumstances, the assessment process may actually encourage potential drivers who are unsure of their abilities and need to be reassured, as it will discourage those who do not have the capacity, see e.g., Simms (1985).

However, wise driver rehabilitation practitioners realize that one must go beyond assessment into the realm of advisement. It is not enough to make a determination of the individual's level of risk: The clinician seeks to help the would-be driver to recognize that risk and its implications for safety. The ultimate goal is to enable and encourage the individual to make responsible decisions about driving and, ideally, to remain in psychological control.

It is important to appreciate as an ideal that predriving procedures not be used to make decisions for the individual. Instead, they should be used in the context of neuropsychological counseling to assist individuals in making appropriate decisions about whether to seek reinstatement of licensure based on their own observation of their performance as it relates to driving.

In the United States the ultimate responsibility for deciding whether the individual can drive belongs to the state Department of Motor Vehicles. Predriving assessment procedures will offer another source of information to the departments of motor vehicles. The procedures will not replace an on-the-road test. Each license-eligible individual who believes themselves to be capable of driving deserves an opportunity to be assessed on-the-road (unless they can be recognized as presenting an immediate risk to the safety of others). The responsibilities of the Departments of Motor

Vehicles can be met effectively with more and better information. New off-the-road procedures, such as the computerized procedures to be described here, will hopefully constitute just that: more and better information.

These may also supplement the information that can be gained by a road test. No road test can be long enough or offer a sufficient variety of circumstances to bring out the abilities that would be needed under many emergency or other low-probability situations. If we can elicit behavior required only in rare emergency situations without waiting for such an exceptional event to occur, we would all be better off. Moreover, driver assessment, like all testing procedures, is guided by implicit or explicit hypotheses about what problems might exist. Many cognitive deficits, however, are not obvious and driving evaluators are rarely trained in neuropsychology. Without this knowledge of what to look for and often without a complete history, they might overlook a significant factor which could affect driving safety, e.g., visual field defect, intermittent diplopia, accommodative insufficiency, hypersomnolence, seizure disorder, inability to sustain attention, inability to shift sets, inability to deal with simultaneous processing demands, etc. Conversely, they might overemphasize evident disorders which need *not* be obstacles to safe driving, e.g., aphasia, memory disorders.

### Laws and Policies Regarding Reinstatement

The laws regarding reinstatement of licensure vary from state to state. Perhaps because the numbers of people who are head-injured and have the potential for the resumption of driving are relatively small, few states have a well-rationalized policy with regard to this group. Although most states have developed policies associated with neurological conditions, especially seizures, and sensory deficits (especially visual), they have not directly addressed the cognitive deficits associated with brain injury including stroke. A *national task force* is needed to prepare model legislation which the states could adapt to their own specific requirements.

Mandatory registration, proposed by Hopewell and Van Zomeren (1988), is a policy which deserves consideration if it can be applied uniformly and in a service-oriented, constructive environment (which does not seem realistic). All persons hospitalized for a period of time with a diagnosis of head trauma, cerebrovascular accident, brain tumor, encephalitis, or other central nervous system disorder would be registered with the Department of Motor Vehicles by the hospital, or, possibly, their insurance

company. This registration would trigger a suspension of licensure together with notification of steps necessary to achieve reinstatement, including assistance in making those steps.

Our purpose is not to be creating the rules, although it is important to know them and to be thinking of improvements. Driver rehabilitation specialists should seek involvement in policy making bodies where possible. Little other than persistence and interest got the present author on the NYS Department of Motor Vehicles' Medical Advisory Board and shortly appointed as the chair of the subcommittee on the elderly and disabled driver. The report of this board, issued in 1992, is a rich source of information and ideas. If copies remain available, it can be obtained without charge from NYS DMV (518 474-0736).

Antrim and Engum have addressed the issues associated with legal liability. They concluded that the best procedure is to actively address the subject of driving using procedures with demonstrated reliability and validity. Avoiding the issue could lead to greater legal risk, as the rehabilitation program is helping the person to recover physical function that permits driving and there is every reason to expect that the individual will attempt to resume driving. Rehabilitation facilities cannot afford to remain passive. 'Don't ask and don't tell' is **not** the best policy.

Returning to the present concerns, social and political policies can be more fairly addressed with valid assessment information, which is what we hope to accomplish with the Driving Advisement procedures. The ultimate test is on-the-road performance following re-establishment of licensure.

Furthermore, a strong recommendation to individuals who've met the requirements of the state for relicensure, is to then take "lessons" with a driver's educator in a dual-controlled vehicle. This extended practice affords individuals the opportunity to assess themselves in a variety of situations with the "insurance" of the driver educator and the dual controls.

## **DRIVING ASSESSMENT OF BRAIN INJURY SURVIVORS - STATE OF THE ART**

Most of the relevant publications are those which are concerned about the safe mobility of older drivers. In 2003 the American Medical Association published a comprehensive guide which should be at the fingertips of all Driver Rehabilitation Specialists: *Physician's Guide to Assessing and Counseling Older Drivers (available on the Internet at <http://www.ama-assn.org/ama/pub/category/10791.html>*. There is also an ongoing European project called **Agile - AGed people Integration, mobility, safety and quality of Life Enhancement through driving** (<http://www.agile.iao.fraunhofer.de>). AGILE has two general aims: (1) developing knowledge to establish rational pan-European policies for delivering certification of fitness to drive and (2) helping the elderly to continue to drive safely for as long as possible. In addition to offering an international perspective, the AGILE reports and "deliverables" are comprehensive and tend to resonate nicely with the philosophy and procedures of the EDS.

Three pioneering reports (Van Zomeren, Brouwer, & Minderhoud, 1987; Hopewell & Van Zomeren, 1987; Van Zomeren, Brouwer, Rothengatter, & Snoek (1988) address the theoretical foundations of driving behavior. These reviewers cite ample evidence for shifting attention from the "operational" skill level to the complex cognitive factors in the "tactical" and "strategic" levels. Indeed they point out that the group of drivers which is most accident-prone (young males) is likely to perform best on measures of operational skill. It is the areas of judgment, insight and planning which are most problematic for the returning brain injured driver.

### **Prevailing Approaches to Pre-Driving Rehabilitation**

See Gianutsos et al. *Assistive Technology* article. A comparison of different methods is contained in the chart *Comparative Summary* on the next page.

## Comparative Summary of Major Driving Assessment Procedures

<i>ISSUE</i>	<i>Porto Clinic/Glare</i>	<i>Driver Performance Test-</i>	<i>Doron Simulator</i>	<i>Driving Advisement System</i>	<i>Elemental Driving Simulator</i>	<i>Neuropsych. Testing</i>	<i>On-road Testing</i>	<i>Cog Behav Driver Inventory</i>	<i>Visual Attention Analyzer – Useful Field of View:</i>	<i>Atari</i>
<b>FACE VALIDITY</b>	Mod. Low	Mod. High	High	Mod. High	Mod. High	Low	Highest	Mod. Low	Mod. Low	Mod. High
<b>SCOPE</b>	Focused	Focused	Focused	Broad	Broad	Test dependent	Broad	Broad	Focused	?
<b>PROTOCOL</b>	Standard	Standard	Select proc.	Standard	Standard	Select proc.	No standard	Standard?	Standard	No standard
<b>NORMS</b>	Marines	Yes	Non-empirical	Yes	Yes	Usually	?	Yes	Yes	No
<b>RELIABILITY</b>	not reported	not reported	not reported	Yes	Yes	Usually	?	Yes?	Yes	No
<b>VALIDITY</b>	not reported	not reported	not reported	Yes	Yes	Not for driv.	?	Yes	Yes	No
<b>TIME (MIN)</b>	15 min.	45 min.	60+ min.	60+ min.	20 min.	15-60 min.	60 min.	60 min.	30 min (?)	60 min.
<b>SPACE / EQUIP.</b>	Tabletop+20'	VCR	Room	Computer	Computer	Tests	Vehicle+	Computer+Test	Console	Console
<b>COST (EST.)</b>	\$1,200.	\$200.	\$30,000.	\$1,800.+	\$1,800.+	<\$500.	Direct + ind.	\$120.++	\$20,000	\$15,000.
<b>SOURCE</b>	DTE	ADSI	Doron	LSA	LSA	Test	self	PSS	VRI	Atari

ADSI = Advanced Driving Skills Institute, 4660 Brayton Terrace South, Palm Harbor, FL 34685 (813) 785-0034

Atari = Atari Games Corp., 675 Sycamore Dr., Milpitas, CA 95035

Doron = Doron Precision Systems, PO Box 400, Binghamton, NY 13902 (607) 772-1610 - Jane Townsend

DTE = Driver Testing Equipment, Inc., 1020 S. Main Ave., Scranton, PA 18504, (717) 347-7772

LSA = Life Science Associates, 1 Fenimore Rd., Bayport, NY 11705, (631) 472-2111

PSS = Psychological Software Services, 6555 Carrollton Ave, Indianapolis, IN 46220, (317) 257-9672

++ CDBI also requires Brake Pedal RT, Keystone Driver Vis. Test, WAIS PC & DS, TrailmakingTest (time, cost addit'l)

VRI = Visual Resources Inc, Kristina K. Berg, 216 S. Jefferson, Suite 600, Chicago, IL 60661 (312) 454-0603

## **Computer Programs for Cognitive Rehabilitation (Vol. 6): Elemental Driving Simulator (EDS)**

The Elemental Driving Simulator (EDS) has been implemented on IBM compatible computers. It consists of three increasingly difficult tasks, preceded by a self-appraisal. Ample practice is afforded throughout. These program has been implemented for IBM compatible computers that run in true DOS mode. Unfortunately, Windows NT, ME, 2000, XP etc. run a simulation of DOS which does not handle timing accurately and so can not be used for the EDS (or LSA's REACT program).

Standardization data and validation are available from over 200 safe drivers ranging in age from late teens to mid 80's.

*Practice.* The design of the procedures affords ample opportunity for practice. Our view is that the amount of practice or number of trials that are needed to develop their skill in driving is *not* important. What is important is the level of proficiency that is ultimately achieved. Therefore, in the assessment we offer the examinees the opportunity to continue in the practice mode almost indefinitely, until they feel they have reached their own best level of performance. Moreover, this approach seems to contribute to the clinical acceptance of these procedures, as people feel that they have been given the fairest possible chance.

### **Preliminaries**

Prior to assessment, several preliminary steps are recommended, including completion of an application, obtaining background information, and determination of eligibility. The computerized tasks themselves will be described following a brief description of these preliminary steps.

### **Application/Background/Interview**

Pre-driving advisement begins with an application phase in which individuals present themselves and state an interest in resuming driving based on a belief that they may now be able to drive. A sample Background Information form is included elsewhere in this manual, along with a general summary of the pre-driving protocol. Included is information regarding driving history and the current status of licensure. Individuals are asked why driving is important to them, and how and when they expect to drive.

*Determination of Eligibility.* There are certain requirements which each state's Department of Motor Vehicles places on individuals who would operate a motor vehicle. One service offered in pre-driving advisement is to inform the individual of the exact

requirements of the Department of Motor Vehicles. Before beginning formal assessment it is important that the relevant specialists on the team review the individual's ability to meet these basic requirements.

*Seizures.* Most states have policies regarding seizures. Some require that the individual be free of seizures for a specified period of time (one or two years), others that the seizures be declared "under control" by a physician.

*Vision.* There are requirements regarding vision, including visual acuity at distance (typically correctable at least to 20/40). Some states have requirements about the field of vision (National Highway Traffic Safety Administration, 1986). In practice we have found it can be difficult to get specific answers regarding some of these details, e.g. field of vision. It is also true that visual field is not routinely assessed in non-brain-injured people who present themselves for driving tests. Generally, standards are minimal and important areas, e.g. binocular function, are not addressed. A comprehensive review (Welner, 1987) offers details, as well as suggestions for reducing the demands of the visual environment. In a recent chapter on vision and driving, Gianutsos (1997, reprinted at the end of this guide) emphasized the need to appreciate the interactive effects of disabilities, including visual problems. While an isolated disability (e.g., a visual field problem) may be accommodated, it may significantly impair driving in combination with another condition (e.g., a hearing loss).

*Motor Function.* In pre-driving assessment it is also important to consider the individual's motor function, both strength and coordination, and range of motion. These assessments can usually be performed by a physical or occupational therapist. Prescription of any adaptive equipment is done by a Certified Driver Rehabilitation Specialist. Further driving assessment would then be done with this adaptive equipment.

The goal of this phase is an assurance that the individual is legally eligible to be licensed and possesses the most basic pre-requisites for safely operating a motor vehicle.

### **Assessment Contract**

Before beginning to assess performance, a discussion is in order. Ask, "Have other people said anything about your driving?" and "What would you do if, after testing, I had to tell you not to drive?" Inquire about the individual's goals in resumption of driving, together with concerns (if any) and expectations. Explain the advisory purpose of the procedures and the importance of satisfying legal requirements. An understanding should be reached as to the disposition of any reports which will come from the evaluation. The procedures themselves should be described and

some understanding of the relative obligations of the evaluator and the evaluatee be made.

I have developed a *Memo of Understanding* which I use to insure mutual acknowledgement of the purpose and limits of the advisement process. My form is included in the section which contains Sample Forms. Each facility has to develop its own form, appropriate to the laws of their own state and policies. Because these policies and procedures have important legal implications, they should be approved by administration following legal review.

These preliminaries, especially the statements of goals and anticipated problems, the views of others, as well as the *Memo of Understanding* should be appreciated as counseling tools. It is important to bear in mind that an important purpose of the assessment is to offer individuals information which will help them make the decision as to whether to proceed with applying for permission to drive again, or to make alternative plans, including further rehabilitation appropriate to this objective, or plans to achieve mobility in some other way.

#### **Additional Procedures**

Four further computerized procedures, collectively known as PERFIELD, are strongly recommended as adjuncts to the assessment: REACT: Reaction Time Measure of Visual Field, SDSST: Single and Double Simultaneous Stimulation, SOSH: Search for the Odd Shape, and SEARCH: Searching for Shapes. These programs are included in the *Computer Programs for Cognitive Rehabilitation*. The PERFIELD programs allow a separation of visual field sensitivity and attentional components to a lateralized differential response, sometimes characterized as "neglect" or "hemimperception." This class of problem has obvious significance for driving safety and is of particular concern because the individual's awareness of the problem may be minimal or altogether lacking. Our clinical experience has been that we have been able to identify individuals with partial losses of vision, which are subtle and for which compensation occurs in most situations. One might argue that if such individuals are generally able to compensate, it may be unnecessary to detect such a problem; however the demands of driving are strict and consequences of even an occasional failure remain severe. Hence we urge the use of the PERFIELD programs to detect differential visual responsivity on the left and right sides.

Use of the PERFIELD programs complements optometric vision screening - a service which Dr. Gianutsos urges for all survivors of significant central nervous system injury. For example, she has written an article for families on *The Importance of Vision Rehabilitation Following Brain Injury*. Philosophical

considerations and practical recommendations for professionals are contained in her articles, including *Vision Screening for Driving Evaluations of Persons with Acquired Brain Injury* and *Visual Field Deficits after Brain Injury: Computerized Screening* where she elaborates practical, dynamic approaches for diagnosing visual field impairment.

# Elemental Driving Simulator

Read the Gianutsos *Behavior Research Methods* article for additional information.

## 1. Philosophy

The EDS is "elemental" in that it focuses on the elements of cognition needed for driving. It is also elemental in taking a very simple, no-frills approach. Practical considerations are important, especially for applications potentially involving large numbers of people. The EDS analyzes basic cognitive processes related to safe driving, with particular emphasis on those processes which are both important and not readily evident to the driver and other observers. Specifically, the "elements" of safe driving designed into the EDS include: judgment, mental processing speed, adjusting to changes and complexity, self-control, eye-hand coordination, consistency, field of view, frustration tolerance and ability to recover. Learning was intentionally *excluded* from the protocol by including ample practice.

Finally, the EDS affords opportunities to observe the individual's ability to sustain performance, particularly to exhibit frustration tolerance and an ability to recover from mishaps, which are also necessary parts of driving. Does one error lead to another, or does the driver get back on track smoothly? Many people experience the EDS as much more demanding than ordinary driving. This increased demand is a result of our attempt to concentrate the challenges of driving into a brief test. For experienced drivers, much of driving is effortless, seemingly automatic and safe; but how does the driver perform when something unusual happens, or things suddenly become busy or dangerous?

Not only is the EDS designed to address relevant cognitive functions, it is implemented in a manner intended to be *clinically effective for attitude and behavioral change*. For example, it includes (1) driving-like features (steering wheel, foot pedal and turn signal) and tasks which appear to parallel driving situations; (2) ample practice and assistance to minimize task-specific learning (driving is an overlearned activity), and (3) a "user-friendly" printed report to take home, so that the findings will be clear and retained after memory fades. Clinical experience makes it clear that people are most likely to believe their results when an assessment has the look and feel of reality.

## 2. Procedures

The EDS is a briefer (20 min), more practical version of the DAS which retains its most useful elements and adds new ones. A comparison of the two procedures is elaborated in the introductory section of this manual. The EDS is implemented on an IBM-compatible computer with the following hardware interfaced through the PS2 mouse port: a steering wheel with a turn signal and a three pedal floor assembly that allows the use of the two side pedals as substitutes for the left and right turn signals. This arrangement allows assessment of pedal control and reaction time, and can be used with hemiplegics.

The EDS procedure begins with a Self-Appraisal task (including 6 ability ratings and a series of Driver Self-Report of current or anticipated driving patterns) and is followed by three increasingly complex preview tracking tasks, denoted Phases I, II, and III.

Throughout the EDS, the protocol calls for ample practice because driving is a well-practiced task, especially in most older drivers. It is expected that some practice is necessary to adjust to the EDS "vehicle" and procedures. Our research has shown that older drivers take three times as much practice as younger drivers. The total administration time requires at least 20 to 30 minutes.

(a) **Self Appraisal** is designed to reveal the participant's judgment as reflected in their degree of confidence in their current driving abilities. Honesty is encouraged and the examiners are to avoid creating the impression that they will be impressed by a high rating. Low ratings are characterized as expressive of "concern" and being "aware that this might be a problem for you now." Individuals are asked to rate their **current** ability on each skill area by turning the wheel to place a marker on the scale on the computer screen. The scale display contains two vertical bars which serve as anchor points designated "LIMIT" and "AVG" (average). To register an above average self-appraisal, the marker would be placed to the right of the AVG bar. The space between "LIMIT" and "AVG" should be used for a below average, but still sufficiently safe rating. Ratings are solicited for the driving-related abilities identified below.

(b) **Driver Self-Report** - Items have been added to the Self-Appraisal section, 9 in all, which give the "Driver Self-Report" (DSR) ratings. These items are from a slightly longer series of ratings developed by Ginger Delibero, OTR/L for a masters thesis on the EDS with community-residing, neurologically normal older drivers. The items are listed below. Only the "When" items are used for the results.

<b>Driver Self Report items added to the EDS</b>	
<u><b>“How” items</b></u>	
<b>SIGNAL</b>	Intentions and check the rear when changing lanes
<b>SEAT BELT</b>	Wear a seat belt
<u><b>“When” items</b></u>	
<b>IN RAIN OR FOG</b>	Drive just as much as others do
<b>IN SNOW OR SLEET</b>	Drive just as much as others do
<b>AT NIGHT</b>	Just as much as others do
<b>HIGHWAYS</b>	Just as often as others do
<b>HIGH TRAFFIC AREAS</b>	As much as others do
<b>UNFAMILIAR ROADS</b>	As often as others do
<b>TRIPS OVER AN HOUR</b>	As often as others do

When you administer the EDS, it is helpful to advise the patient when you shift to the DSR items, for example, by saying “The next items have to do with certain choices that people make when driving.” If you are working with someone who seeks to resume driving following an injury or stroke, emphasize that they should answer these items to show how they anticipate they will drive, not the decisions they would have made in the past.

On the reports, you will notice that there are summary scores for DSR, together with the usual EDS summary scores. The DSR is more likely to reflect the person’s behavior, or at least their intentions, while the EDS Self-Appraisal reflects their psychological feelings of confidence and competence. It is well to keep this in mind when counseling the individual.

(c) *Preview Tracking* is organized into three phases:

1) **Phase I: On the Road.** This basic steering task is a variant of some of the arcade games, called "preview tracking." It is based on Jones, Giddens and Croft's (1983) task, but somewhat different in that the "track" is a road with two edges. The "driver" holds the "gas pedal" down to begin and then uses the steering wheel to keep their "vehicle" marker in the center of the road while the road winds unpredictably. The impression is that one is proceeding along a windy country road. Phase I provides a baseline against which to evaluate performance in subsequent phases when simultaneous demands are imposed.

If the vehicle passes out of the boundaries of the road, it "crashes" and the display stops with a prompt to release the "gas" and center the vehicle before resuming.

Practice is essential. If an additional practice run is not sufficient to establish stable performance, there is an option to drop back to a "gradual warm-up" procedure in which the vehicle moves slowly and speeds up only when performance meets an established criterion. The

test phase is only begun after practice. The *test phase* lasts about one minute.

(2) **Phase II: Watching for "Fred."** Here we add a requirement that the person monitor the screen for the unpredictable appearance of "Fred," a small face symbol. As soon as the "Fred" face appears, they are to acknowledge it with the turn signal. Speed of response is important. Again, practice is offered and an additional practice run as an option. The turn signal springs back to the center position automatically.

If the person signals in the wrong direction, the trial is categorized as an error. During practice, feedback is offered, but once the person decides leave practice and to go "on record" feedback is no longer given. Error trials are noted, but those trials are re-presented later, so that reaction times are recorded for correct trials only. Further, in the unlikely event that the person makes over 10 errors in this phase, the drive is immediately halted with a choice of (1) returning to practice mode and later resuming the test, or (2) discontinuing the EDS altogether.

In the EDS, as in real driving, errors should occur relatively rarely, if at all. If the person takes enough time and understands the procedures, they should not make many errors. The purpose of the wrong response limit is to prevent undue haste and sloppy responding. After all, this is not an arcade game!

(3) **Phase III: Hazard Avoidance.** Further complexity is added by forcing the individual to make a choice: to move the turn signal *towards* steady face symbols; but to move *away* from flashing face symbols. This procedure indicates whether the person will slow down as much as is necessary in order to make the right decision. This kind of restraint is essential to avoid making impulsive errors while driving. On the other hand, we need to see if the person can deal quickly enough with more complex situations where a choice has to be made. Do

they make the right decision and do they make it quickly enough?

With regard to errors, which are more common in Phase 3, the same policies as in Phase 2 apply, e.g., feedback only in practice, re-presenting error trials later, and 10 error limit.

Following each phase, "Intermediate Results" are presented on the screen with the individual's scores indicated on the same scale used earlier for self appraisal. The standard of comparison is the performance of normal, safe driving "control" subjects. (The EDS allows some options in selecting the appropriate comparison group: older people may be compared with a large group of AARP members.) The steadiness of steering is shown, as well as response speed in Phases 2 and 3. A note at the top of the screen advises if the person had a tendency to stay too far to the left or to the right, as well. This feedback promotes awareness of performance, and often inspires maximum effort.

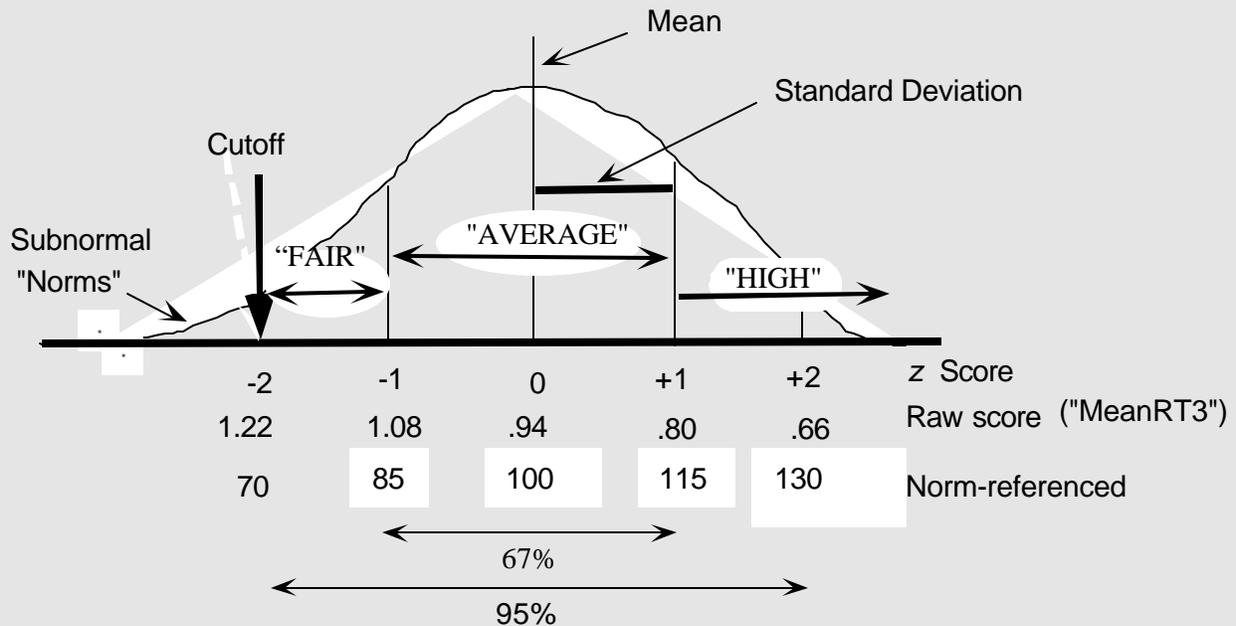
At the conclusion of testing, the EDS saves the raw data automatically to a disk file (LSA\COGDAT\EDS.CUM - For specifics see Section III) and produces two printed reports: A "Data Sheet" and an "Individual Report," samples of which may be found later in this section. Printing of these reports may be deferred and archived for later review and printing. It is suggested that you accept the offer to archive the reports: they do not consume much space. The EDS.CUM file adds the numeric data for each subject into a single file to facilitate conversion of the data file into a spreadsheet for research use.

#### EDS Measurement Issues

The indices on the EDS Personal Report are derived from performance measures summarized on the EDS Data Sheet. The information which follows explains the derivation and interpretation of these measures. On the Personal Report (and at the bottom of the Data Sheet), the measures are reported as norm-referenced scaled scores, based on 100 as the average normal score and 70 as the lower limit of normalcy ('cutoff'). Important: If you are rusty or unfamiliar with the normal curve model and basic descriptive statistics, read the detailed explanation of the "Normal Curve Model" later in this section,

## Normal Curve Model

*Skip this section if you are familiar with basic statistics.*



This example uses "AVERAGE3" the average reaction time in phase 3. Since a lower reaction time is better, *above average* scores are *lower* than .95, the mean (computed from the scores of the "norm" subjects). Above is a stylized "frequency distribution" which reflects the number of people (vertical axis) who obtained a given score (horizontal axis).

- 1) the *mean (average)* score is a measure of "central tendency" and the *standard deviation* reflects the "variability." Here, the average Phase 3 reaction time is about .94 and the standard deviation is .14.
- 2) two thirds of the cases fall within one standard deviation of the mean, or between .80 and 1.08 sec.
- 3) of the cases fall within 2 standard deviations of the mean, or between .66 and 1.22.
- 4) raw scores can be converted into "z scores" which simply reflect the number of standard deviation units that score falls from the mean.
- 5) for understandability, these z scores are transformed to a scale where 100 is average and there is a 15 point standard deviation. We expect 95% of these *norm-referenced* scores to fall between 70 and 130.
- 6) We take advantage of these facts to adopt as a clinical cutoff the score corresponding to  $z = -2.$ , or a norm-referenced scaled score = 70. We can assume that no more than about 2.5% of the normal subjects would score that low. For ADJUSTING (Phase 3 Complex Reaction Time) the raw cutoff score is 1.22. Further, norm-referenced scores are on a common scale, which allows us, for example, to compare reaction time and impulsivity (So we could say, "he's abnormally slow but not impulsive.")

## Response Times

Response times can be compared across the three phases to see how much, if at all, a person's performance declines when other demands are being placed on them, as in Phases 2 and 3. The scores are further broken down by whether the stimuli appeared on the left or right side of the display. Normally we do not expect any significant side of display preference. Substantial lateralized differences would suggest possible central nervous system dysfunction. Both means and medians are reported and if they differ substantially, it suggests that there were lapses or irregularities in the performance. These would be very significant for driving.

The summary measures are derived from raw performance measures. The individual's own self appraisal ratings are plotted on the same scale, using  $AVG = 100$  and  $LIMIT = 70$  (2 SDs below average). Patterns of over- or under-confidence are reflected in discrepancies between the self-appraisal and performance ratings. Good metacognition is reflected in concordance between the two ratings.

## .EDS Summary Measures

### STEERING UNSTEADINESS (STANDARD DEV)

This index measures steering unsteadiness, or, more precisely, the variation in the absolute (doesn't matter if it's to the left or right) lateral position of the vehicle on the road. Measurement samples are taken 7 to 8 times in each second. The road has 9 possible positions, with 5 being the middle. Steering standard deviation is converted to a norm-referenced scale on the EDS reports, so that you can immediately determine if the person's performance was above average (100). An alternate measure of steering is **WOBBLE**, the average change in lateral position from time-sample to time-sample. The average change is typically less than half a position. However, the units of **WOBBLE** are essentially arbitrary. Wobble represents the "jiggle" or how shaky the steering is; whereas, standard deviation captures both "jiggle" and lateral "drift."

### REACT

This index is simple (two-alternatives) reaction time measured in hundredths of a second. On the EDS the response is activation of a turn signal lever up or down to acknowledge a pseudo-randomly appearing stimulus on the right or left side (while continuing to steer). This reaction time combines both "choice" (decision) and "execution" (motor) components.

### FIELD

This index is derived from the difference in the median reaction times to right and left side stimuli during phases 2 and 3. For each phase the  $Right\ mdn - Left\ mdn$  (see EDS Data Sheet) captures lateralized differences in responding. If this difference is positive, responding is slower on the Right, if negative it's slower on the Left. On the EDS Personal Report the **FIELD** index is the average of the absolute values of  $R\ mdn - L\ mdn$  for Phases 2 and 3. The absolute values (making both values positive) are used to emphasize the magnitude of lateralized differences, regardless of the direction. A high **FIELD** index, therefore, should alert one to the presence of lateralized differences: in order to determine the direction of those differences one has to look at the Right-Left medians on the EDS Data Sheet. In some cases, lateralized differences in one phase will appear to be reversed on the next phase: because the **FIELD** measure uses absolute differences, a bias to one side on Phase 2 will *not* be canceled by a bias to the other side on Phase 3. Among driver rehabilitation specialists there seems to be a consensus that lateralized visual impairment leads to poor centering and lateral inconsistency; however, problems can occur on either side.

### ADJUST

This index the median reaction time in hundredths of a second on the most complex task of the EDS: Phase 3, where the two-alternatives response is contingent on whether the stimulus is steady or flashing. It represents the individual's ability to adjust responding efficiently in response to more complex demands.

### SELF CONTROL

This index is based on the percent errors on Phase 3. Since there are 20 trials, each wrong response translates into 5% error. In the EDS, as in real driving, errors should occur relatively rarely, if at all. If the person takes enough time and understands the procedures, they should not make many errors. The purpose of the wrong response limit is to prevent undue haste and sloppy responding. After all, this is not an arcade game!

<b>Attribute</b>	<b>Description</b>	<ul style="list-style-type: none"> <li><b>Driving example</b></li> </ul>	<b>Self-Appraisal</b>	<b>EDS Performance</b>
<b>Steering Control</b>	Steadiness and coordination	<ul style="list-style-type: none"> <li>Narrow 2 way streets</li> <li>Mountain roads</li> <li>Parking</li> <li>Narrowed construction lanes</li> </ul>	Eye-hand coordination; ability to steer accurately and steadily	Steering Standard Deviation averaged across all three phases. Standard Deviation is the variability in deviation from center on the roadway
<b>Reaction Speed</b>	Simple reaction time	<ul style="list-style-type: none"> <li>Sudden presence of unambiguous hazard</li> <li>Emergency response</li> </ul>	Basic response time; little thinking or decision making involved	Median reaction time* for Phase 2 (WATCHING FOR "FRED"); mean reaction time is an alternate measure
<b>Visual Field</b>	Aware of the far left and far right	<ul style="list-style-type: none"> <li>Aware of vehicles in other lanes on highway</li> <li>Pedestrians, cyclists entering roadway</li> <li>Intersection events</li> </ul>	Consistency of response to both sides of the display	Difference between Right and Left Median Response on Phases 2 and 3
<b>Adjusting</b>	Quickly and easily to changes	<ul style="list-style-type: none"> <li>Unexpected (other) driver error</li> <li>Rental or borrowed car</li> <li>Driving on the other side of the road</li> <li>Construction zone changes</li> <li>Emergency sirens heard</li> <li>Accident has just occurred</li> <li>Weather changes (e.g., hail)</li> </ul>	Processing efficiency in complex situations; ability to respond flexibly, as in an emergency or new situation	Median reaction time* for Phase 3 (HAZARD AVOIDANCE); mean reaction time is an alternate measure
<b>Self-Control</b>	Resist the urge to act quickly when more thought is required	<ul style="list-style-type: none"> <li>Deciding when to pass another car</li> <li>Deciding when to merge onto highway</li> <li>(Not) making turns/lane changes at the last minute</li> <li>(Not) advancing when other traffic does, even though they have the light and you don't</li> <li>(Not) advancing on delayed green</li> </ul>	Ability to refrain from, or to retract, and action, such as not slamming on the brakes on an icy road	Erroneous signal responses (%) in Phase 3
<b>Consistency</b>	Driving in the same way	<ul style="list-style-type: none"> <li>(Not) accelerating and decelerating rapidly</li> <li>(Not) making frequent lane changes</li> <li>(Not) letting emotions influence your driving (avoiding road rage)</li> <li>(Not) having good days and bad days</li> </ul>	Predictability of driver's behavior to other drivers, ability to sustain a level of performance; regularity of performance	Difference between mean and median reaction time in all test phases;** standard deviation of response times is an alternate index

## EDS Measures

### CONSIST

This index captures the consistency of responding to peripheral stimuli in Phases 2 and 3. Since, especially in driving, the concern is with occasional lapses, or long reaction times, this type of inconsistency will be reflected in the difference between the mean (average) and the median. This measure takes advantage of the fact that the average reaction time can be pulled up by a few instances of lapsed attention; while the median is immune to such lapses.

To illustrate this fact, consider the following examples in which consistent performance (Ex. 1) is compared to performance on which one trial lapses to .89 sec (Ex. 2).

Reaction Time (sec)	Ex. 1	Ex. 2
	=====	=====
	2	2
	3	3
	2	2
	4	4
	4	.89
	==	==
Mean -->	3	20
Median ->	3	3

*Note - one lapsed score explodes the **mean** and leaves the median unchanged.*

A problem which arises in computing the average and standard deviation is how to handle those trials on which there was no response prior to the time limit. Strictly, these trials are “undefined” and so is the mean and standard deviation for the series of trials. However, in order to assure that there would be no undefined values, on the EDS we used the technically unkosher procedure of assigning the time limit for those trials. This statistical compromise has worked out well, as the time limits are long enough (2.56 sec) to pull up the mean reaction time substantially.

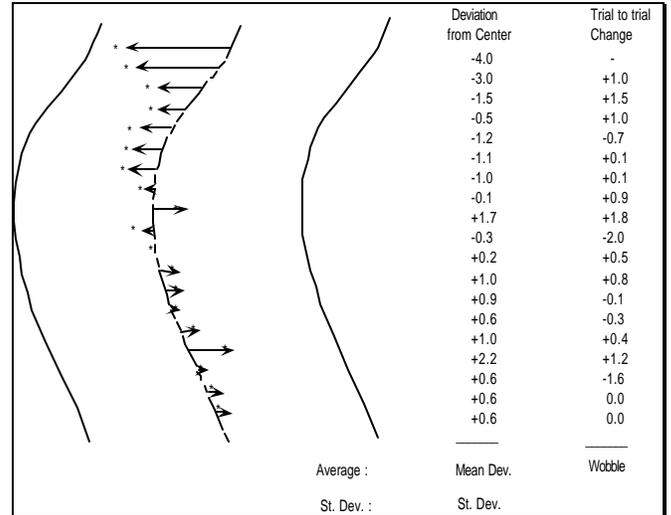
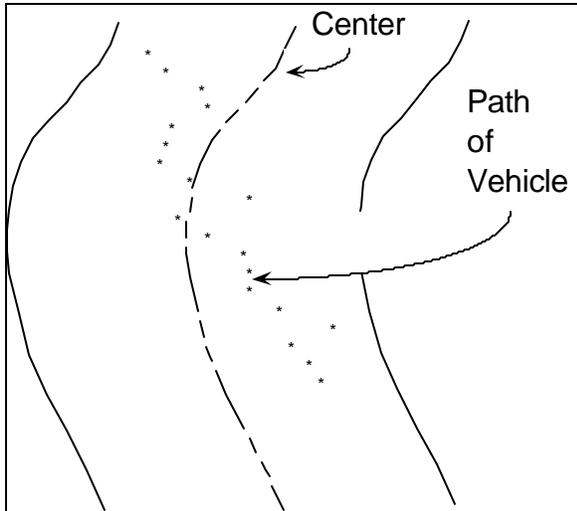
\*\* Since the mean is sensitive to lapses and the median is not, the difference between the two captures the degree of inconsistency in responding.

### Measures of steering unsteadiness and drift: Standard deviation, wobble and mean deviation

The EDS road is represented by dots corresponding to the left and right shoulder of the “road.” At each dot the placement of the vehicle corresponds to a number of deviation units from the center. On the DAS and EDS there are 9 units and each measurement is based on whole number deviations from the center (position 5). In the example below, we have used fractional deviations, instead of the 9 position, whole number actually used. The measures are in (rather meaningless) computer units. Usually you interpret them by reference to the values obtained by the norm group.

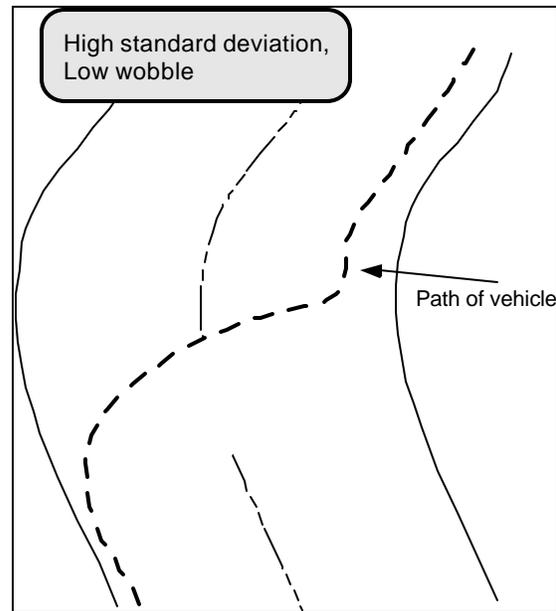
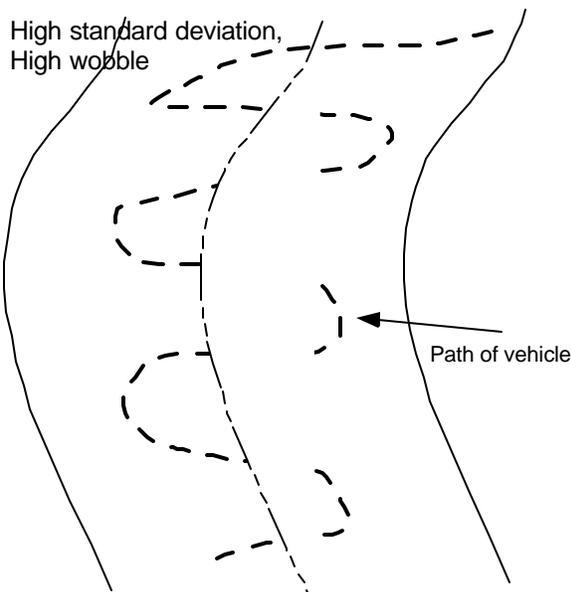
The *average (mean) deviation* score reflects the general tendency to stay to the left (negative) or right (positive) of the center. If the person starts out on one side, but crosses over to the other part way through, the deviations will cancel one another and the average will be close to zero.

Unsteadiness is measured by the *standard deviation* of the deviation scores on both DAS and the EDS. A value less than 1.00 is usually quite acceptable. The cutoff is about 1.35 and the world record is a low of .54.



A second measure of (un)steadiness is offered: "wobble." Wobble, the average change in the distance from center from point to point along the "road," was introduced to isolate moment-to-moment variation, or jiggle, as distinct from more gradual deceleration, or drift. *WOBBLE*, captures the change in the vehicle's position (relative to the center of the road) from moment to moment. It was designed to correct a theoretical artifact which would lead to a high standard deviation despite steady steering, e.g., drifting and weaving. Typical wobble values are .42 with a cutoff of .48. The **Wobble** index was demoted

after about a year of clinical experience with the EDS. We returned to the measure used in the DAS, the **Standard Deviation** of the lateral car position on the road. This measure proved more valid, incorporating both jiggle and tendency to drift from center (while Wobble only picks up on jiggle, but not drift.) If you have one of the earlier versions of the EDS, you will find that the steering steadiness now correlates better with the crashes and scrapes, and will make more sense both to you and to your patients.



## EDS Norms and Research Findings.....

Currently the EDS is standardized on a group of over 150 neurologically normal drivers ranging in age from 18 to 80 years of age. These data afford normative measures for the broad range of drivers.

06/15/20 EDS Norm 01 Data			Mean (Avg)	Standard Deviation	Cutoff (Mean +2*SD)
EDS Norms					
<b>180.00</b>	Licensed Drivers	from 18 to 80 years			
BKGD	MILES	Annual miles (self report)	13.88	6.79	27.47
BKGD	VIOLATIONS	Annual violations (self report)	0.13	0.37	0.88
BKGD	CRASHES	Annual driver crashes (self report)	0.17	0.42	1.01
	Norm Group Info				
	ColorBW	Color or Black&White signals			
SA	STEERSA	Steering Self Appraisal (scaled)	102.64	6.93	116.50
SA	REACTSA	Reaction Time Self Appraisal (scaled)	102.93	7.15	117.22
SA	FIELDSEA	Visual Field Self Appraisal (scaled)	102.99	6.73	116.45
SA	ADJUSTSA	Adjustment (Complex RT) (scaled)	102.89	7.08	117.06
SA	SELFCSA	Self Control (Error %) (scaled)	101.39	7.95	117.29
SA	CNSISTA	Consistency (Avg-Mdn) (scaled)	103.74	7.52	118.79
STEER	DIST1	Distance - Phase 1	499.56	4.40	508.36
STEER	TIME1	Time - Phase 1	1.04	0.01	1.06
STEER	TIMEOUT1	Time outs - Phase 1	0.00	0.00	0.00
STEER	SCRAPEN1	Scrapes - Phase 1	1.53	2.42	6.37
STEER	CRASHN1	Crashes - Phase 1	0.26	0.54	1.33
STEER	DEVIATE1	Deviation from center - Phase 1	-0.11	0.16	0.21
STEER	STDEV1	St. Deviation (Integrated error)-Ph 1	1.00	0.17	1.34
STEER	WOBBLE1	Wobble (point-to-point) change - Ph 1	0.42	0.04	0.50
STEER	DIST2	Distance - Phase 2	1369.57	140.64	1650.84
STEER	TIME2	Time - Phase 2	2.86	0.29	3.45
STEER	TIMEOUT2	Time outs - Phase 2	0.00	0.00	0.00
STEER	SCRAPEN2	Scrapes - Phase 2	4.43	5.54	15.52
STEER	CRASHN2	Crashes - Phase 2	0.63	1.20	3.03
STEER	DEVIATE2	Deviation from center - Phase 2	-0.10	0.16	0.22
STEER	STDEV2	St. Deviation (Integrated error)-Ph 2	1.04	0.17	1.39
STEER	WOBBLE2	Wobble (point-to-point) change - Ph 2	0.42	0.04	0.50
STEER	DIST3	Distance - Phase 3	1378.06	118.64	1615.34
STEER	TIME3	Time - Phase 3	2.88	0.25	3.38
STEER	TIMEOUT3	Time outs - Phase 3	0.00	0.00	0.00
STEER	SCRAPEN3	Scrapes - Phase 3	3.19	4.06	11.32
STEER	CRASHN3	Crashes - Phase 3	0.43	0.92	2.27
STEER	DEVIATE3	Deviation from center - Phase 3	-0.10	0.14	0.18
STEER	STDEV3	St. Deviation (Integrated error)-Ph 3	0.99	0.15	1.29
STEER	WOBBLE3	Wobble (point-to-point) change-Ph 3	0.42	0.03	0.49

REACT	NLEFT2	N Trials on Left - Phase 2	10.00	0.00	10.00
REACT	NRIGHT2	N Trials on Right - Phase 2	10.00	0.00	10.00
REACT	RLAVDIF2	R Avg. - L Avg. RT (Phase 2)	0.03	0.08	0.20
REACT	AVERAGE2	Average Reaction Time (RT) - Phase 2	0.59	0.09	0.76
REACT	RLMDDIF2	R Mdn - L Mdn RT (Phase 2)	0.04	0.07	0.18
REACT	MEDIAN2	Median Reaction Time (RT) - Phase 2	0.58	0.08	0.74
REACT	STDEVRT2	St. Deviation of Phase 2 RT	0.12	0.07	0.25
REACT	ERR2PCT	Error Pct. on Phase 2	5.78	5.38	16.55
REACT	LEFTN3	N Trials on Left - Phase 3	10.00	0.00	10.00
REACT	RIGHTN3	N Trials on Right - Phase 3	10.00	0.00	10.00
REACT	RLAVDIF3	R Avg. - L Avg. RT (Phase 3)	0.01	0.11	0.22
REACT	AVERAGE3	Average Reaction Time (RT) - Phase 3	0.93	0.14	1.20
REACT	RLMDDIF3	R Mdn - L Mdn RT (Phase 3)	0.00	0.10	0.21
REACT	MEDIAN3	Median Reaction Time (RT) - Phase 3	0.90	0.13	1.17
REACT	STDEVRT3	St. Deviation of Phase 3 RT	0.19	0.09	0.38
REACT	ERR3PCT	Error Pct. on Phase 3	6.22	7.37	20.97
	Practmin	n/a	3.51	1.79	7.09
	Practsec	n/a	16.39	19.52	55.43
			<b>AVG</b>	<b>STD</b>	<b>CUTOFF</b>
	<b>PHASES</b>	<b>EDS Phases completed</b>	<b>3.00</b>	<b>0.00</b>	<b>3.00</b>
SUMRY	STEER SD	Avg. steer SD Phases 1-3	1.01	0.14	1.30
SUMRY	REACT	Median Reaction Time - Phase 2	0.58	0.08	0.74
SUMRY	FIELD	(@abs(RLmdnDIF2)+@ABS(RLmdnDIF3))/2	0.07	0.04	0.16
SUMRY	ADJUST	Median Reaction Time - Phase 3	0.90	0.13	1.17
SUMRY	SELFCONT	Pct. Errors Phase 3	6.22	7.37	20.97
SUMRY	CONSIST	((Avg2-Mdn2)+(Avg3-Mdn3))/2	0.02	0.02	0.06
	PRACTSEC	Practice time (seconds)	218.24	102.54	423.32
	DX_GROUP	n/a			
	n/a				
	AGE	in years (self-report)	35.24	11.33	57.91
	PSteerSD	P (>cutoff) Steer SD(Phases 1-3)	0.96	0.21	0.54
	PReact	P (>cutoff) Reaction Time (Ph 2 Mdn)	0.96	0.19	0.57
	PField	P (>cutoff) Field (R-L Mdn Diff Ph 2&3)	0.96	0.19	0.57
	PAdjust	P (>cutoff) Adjustment (Ph 3 Mdn RT)	0.97	0.18	0.61
	PSelfCon	P (>cutoff) Self-Control (Ph 3 Error %)	0.96	0.19	0.57
	PConsist	P (>cutoff) Consistency (Avg-Mdn)	0.96	0.21	0.54
	Passcore	Number Scales Passed: (>cutoff)	5.76	0.61	4.54
SCALE	Steer SD	SteerSD (Phases 1-3) (scaled)	100.00	15.00	70.00
SCALE	React	Reaction Time (Phase 2 Mdn) (scaled)	100.00	15.00	70.00
SCALE	Field	Field (R-L Mdn Diff) (scaled)	100.00	15.00	70.00
SCALE	Adjust	Adjustment (Phase 3 Mdn RT) (scaled)	100.00	15.00	70.00
SCALE	SelfCon	Self-Control (Ph. 3 Error %) (scaled)	100.00	15.00	70.00
SCALE	Consist	Consistency (Avg-Mdn) (scaled)	100.00	15.00	70.00

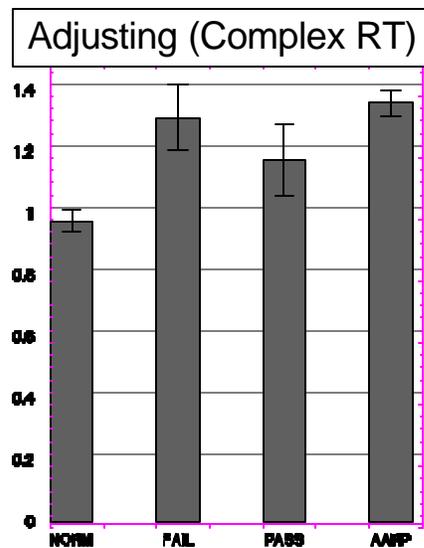
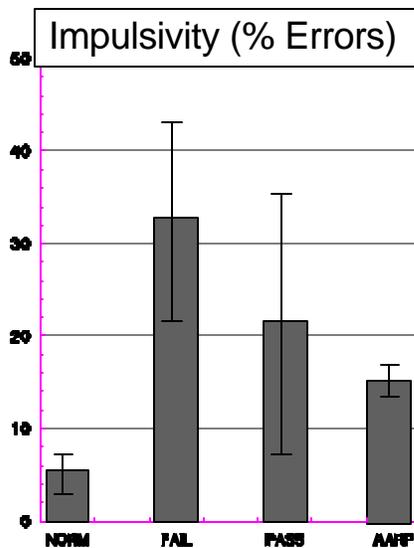
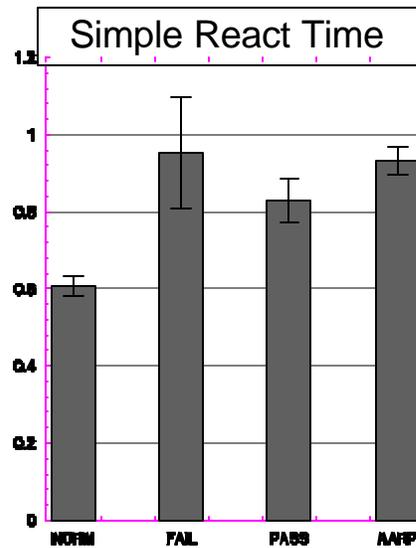
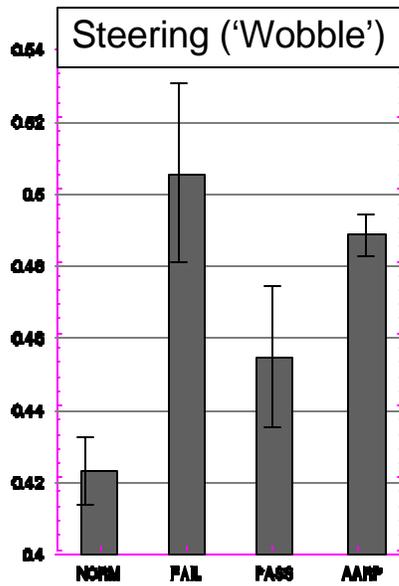
	SA_AVG	Average Self-Appraisal (scaled)	102.71	5.54	91.63
	Perf_AVG	Average Performance (scaled)	100.15	8.53	83.09
	PSAindex	Perf Scaled- Self Appraisal Scaled	-2.28	13.20	24.12
	SCPSA	Scaled PSA Index	100.32	14.16	72.01
	SIGNALSA		106.08	8.39	89.30
	SEATBLSA		115.00	13.66	87.69
DSRWhen	RAINFX	in rain or fog	101.08	8.20	84.67
DSRWhen	SNOWFX	in snow or sleet	97.08	9.38	78.31
DSRWhen	NIGHTFX	at night	101.97	9.49	82.99
DSRWhen	HIWAYFX	on highways	105.74	8.55	88.64
DSRWhen	TRAFICFX	in high traffic areas	102.11	8.40	85.30
DSRWhen	UNFAMFX	on unfamiliar roads	101.26	8.33	84.61
DSRWhen	FARFX	trips over an hour	104.33	9.92	84.49

## Validation Studies.....

*Community-residing older drivers.*

A. Hartford/AARP (At fault crashes). A large-scale data collection effort on the EDS involved a sample of older drivers (the Hartford/AARP study - data obtained through cooperative arrangement with the study investigators) ( $n = 1267$ ): These data demonstrate the practicality and reliability of using the EDS with older drivers. We have limited information about these persons other than that they were policyholders solicited through a cooperative

arrangement between the Hartford Insurance Company and the American Association of Retired Persons. Most were still driving. Administration occurred in supervised small groups. Testing was conducted sequentially in Connecticut, Florida and Illinois. Graphic results (below) include these groups and the normative drivers. Most ( $n = 951$ ), but not all AARP participants completed all 3 phases while all normative drivers completed all phases.



*Performance on EDS measures by 1,276 persons from four subgroups (bars from left to right in each panel): NORM = drivers without neurological diagnosis; FAIL = failed comprehensive rehabilitative driver evaluation, including on-road assessment, if it could be performed safely; PASS = passed comprehensive driver evaluation; and AARP = older members of American Association of Retired Persons currently driving and participating as volunteers.*

Comparisons of the AARP/Hartford sample with the normative drivers shows consistent and substantial differences with the older group generally being slower but not more impulsive than the younger group. Except for the steering unsteadiness ("wobble") measure, there were no differences among the AARP geographic subgroups. The wobble difference is an artifact reflecting an improvement in the steering wheel reliability. Preliminary validation findings (J. Brown and J. Mitchel, personal communication) indicate that the EDS produced a small ( $r = .08$ ) but statistically significant correlation with at-fault accidents. The best individual predictor was performance on the Pelli-Robson Contrast Sensitivity Chart ( $r = .11$ ). The Useful Field of View correlated .05 with at-fault accidents. These disappointing correlations can be partially explained by such factors as: restriction of range (e.g., since the subjects were volunteer policyholders, the worst drivers may not have been

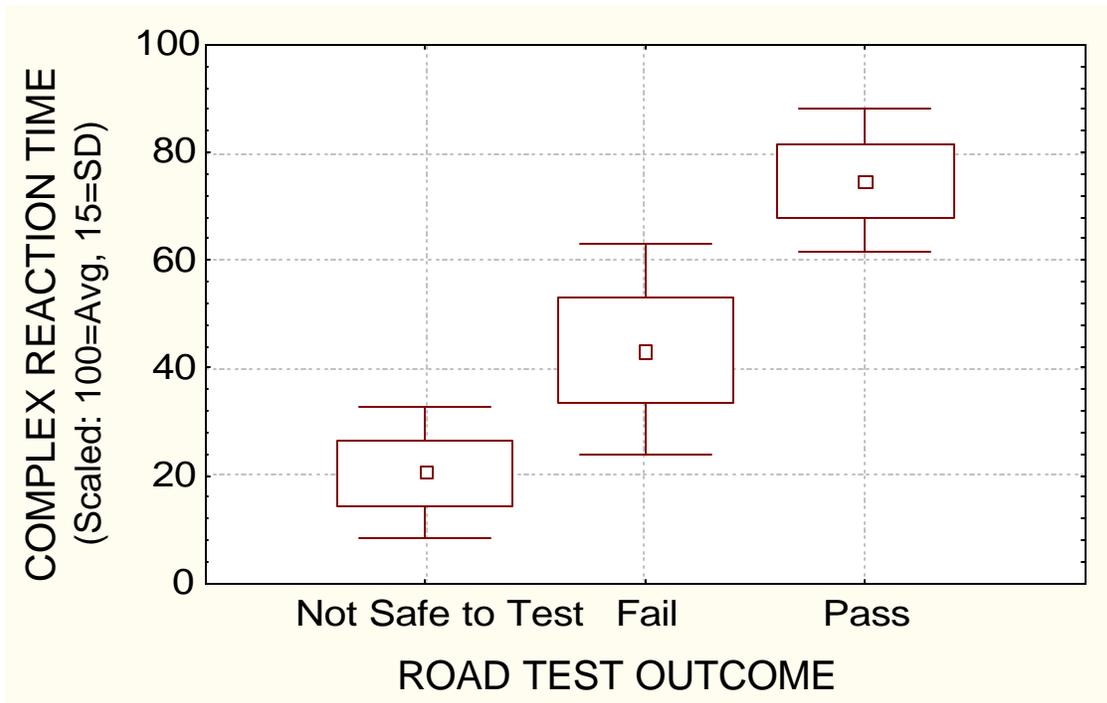
sampled adequately), and attenuation of driving risk and consequent at-fault accidents through self-restriction of driving, e.g., one of a handful of outliers (poor performers) on the EDS measures turned out to be an AARP volunteer defensive driving instructor who had "just decided to stop driving before he had an accident."

**B. Delibero (Driver Self Report).** In a study of older and younger drivers without any neurological diagnosis found that (1) older drivers can do the EDS, but require 3 times as much practice, (2) their performance is generally much lower, with scores averaging close to the usual cutoff of 70 points, (3) they give self-appraisals which are, if anything, **higher** than the younger drivers, but (4) their performance correlates highly (.69) with their responses on the Driver Self Report (DSR) items. These findings are tabulated below:

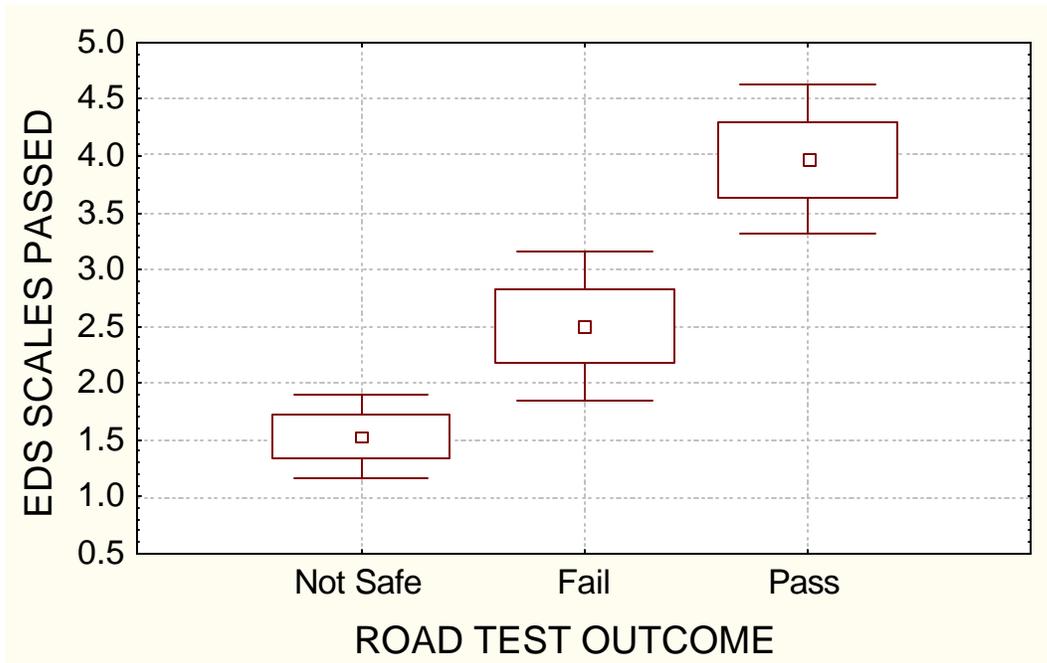
<b>Summary of Delibero Results and EDS Norms</b>				
<b>Measures</b>	<b>Students</b>	<b>EDS</b>		<b>Signif.</b>
		<b>Norms *</b>	<b>Seniors</b>	
	(a)	(b)	(c)	$p < .05$
<b>N</b>	20	103	19**	
<b>Age</b>	26.32	36.79	75.51	a < b < c
<b>Annual Miles</b>	16,200	13,320	7,053	a < b < c
<b>Annual Violations</b>	.15	.11	0	b < c
<b>Annual Crashes</b>	.10	.17	.05	b < c
<b>Practice Time (min)</b>	3.68	2.92	9.56	a < b < c
<b>EDS: Performance Avg.</b>	99.76	100.00	68.74	a & b < c
<b>EDS: Self-Appraisal</b>	104.20	103.39	105.53	b < c
<b>DSR: When</b>	109.03	**	97.13	a < c
* Group "b" (EDS Norms) were never given the DSR.				
** Excludes one 90 yr. old senior who was unable to learn the baseline steering task of the EDS and one who withdrew from the study after Phase 1.				

*Drivers in Brain Injury Rehabilitation*

Campbell (On Road Assessment). For over 20 years Amy Campbell, OTR/L, CDRS now of the Easter Seal Mobility Center in Meriden, Ct has performed comprehensive driving evaluations of brain injured individuals who came into a rehabilitation center, Gaylord Hospital. A variety of diagnoses are represented, including stroke, head injury, along with congenital disabilities, e.g., cerebral palsy. She has become proficient in all aspects of the assessment process, including the on road (behind the wheel) component. In this research the focus was on the relationship between EDS performance and the outcome of the road test..



Each mean is surrounded by a box representing a 1 standard error spread from the mean and a "whisker" showing 1.96 stand errors. If the whisker of one group does not include the mean of another, then the two groups are likely to be statistically significantly different. In the case of Complex Reaction Time, the passers were significantly faster than the failers, who, in turn, were slower than those deemed "not safe to test."



#### Conclusions

These studies with both simulator-like advisement-oriented driving assessments (the DAS and the EDS) demonstrate that such an approach is feasible, reliable and valid. In the EDS we have developed a protocol which most older drivers can perform and which can be completed in a brief time interval (20 mins.) which is short enough to permit large-scale implementation. The complete system is not costly and a printed report is produced instantly. Administration and interpretation of the procedures are reasonably straightforward. The DAS/Gaylord studies offer concurrent and predictive validation with a clinical population. Practical clinical experience has reinforced the positive findings from formal validation studies and, in particular, confirmed the value of the strategy of comparing self-appraisal with subsequent performance.

**Hemiplegia adaptation.** Many of the survivors of brain injury who are candidates for driving advisement are hemiplegic. This physical disability is not difficult to adapt for driving. The adaptation which one must use for the EDS is, however, different. The best method is to use the DAS three pedal floor switch. If you don't have one, you may purchase one from Life Science Associates. The middle pedal is the GAS, the left pedal is the LEFT signal, and the right pedal is the RIGHT signal. Use

this for the EDS: everything can be done with one arm and one foot. Don't worry about taking your foot off the gas in order to signal left or right. Your "car" will not stop

An alternative approach is to run the DAS/RT (Reaction Time) programs (BRAKE, DECIDE and INHIBIT) with the 3 pedal floor switch. The advantage of this approach is that ample formal norms exist and it allows separation of the choice (mental) and execution (motor) components.

## Case Example 1:

### Aware Left Hemianopic Driver (ALHD)

A 65 year old gentleman, who had sustained a cerebral hemorrhage 4 months earlier, was referred by his optometrist with a diagnosis of complete dense left homonymous hemianopia. ALHD was aware of his visual problem and very consciously looked about 20 degrees to the left to compensate. He reported that the optometrist had told him that his vision should not hinder his driving; however, later he acknowledged that an ophthalmologist had told him not to drive (but in a casual, almost joking manner, which belied the seriousness of the advice).

ALHD had gone out with a driving instructor (to whom he was recommended by a rehabilitation facility) for a series of lessons. The instructor had now advised him to begin driving independently again. He reported that he would often have to slow down, even on the highway (to 40 or 45 mph), and finds unfamiliar routes very difficult. He got lost driving to the evaluation session, even though he had done a dry run a few days earlier. His family members are reluctant to ride with him, and did not observe him during his driving lessons.

ALHD showed no signs of physical disability. He was articulate and made all the arrangements himself. During our session he bumped into a bookshelf with his left shoulder. He needed assistance reading an information form.

At present ALHD was on disability leave from his employment of many years (college professor) and he would have to drive in order to return to work). At the moment he wants to drive about 10 miles of urban highway and interchange to weekly meetings at a club where he sees his friends. He has never used public transportation and did not see that as an acceptable alternative. He often acknowledged problems, but tended to minimize their significance.

ALHD was able to drive legally in New York State because of a loophole in the DMV code (visual field is only assessed if acuities fall into a marginal range; there is no mandatory reporting).

A dynamic visual field evaluation was conducted using REACT and SDSST prior to doing the EDS. ALHD responded to REACT by looking at the left edge of the computer monitor. His responses were somewhat slowed and more variable - although not clearly impaired. It did not matter much whether the contrast was high or low, or if the stimuli were dynamic or static. When required to fixate on the center of the screen, ALHD no longer responded to any of the stimuli on the left.

Laterality was **not** marked in his SDSST performance; however, there were clearly more errors. ALHD's awareness of his deficit and consequent efforts to compensate were quite evident - sometimes he missed on the right because he was struggling to catch something on the left

-----  
Elemental Driving Simulator: Personal Report

Name: "ALHD" Date of Birth: xx/xx/xx Date of Test: 06/16/94  
 Annual mi.: 10000 Violations: 0 MV Crashes: 0  
 Reference Group: Licensed drivers from 18 to 80  
 S/P CEREBRAL HEMORRHAGE 1/94 W L HOMONYMOUS HEMIANOPIA

AREA	PERFORMANCE	SELF-APPRAISAL
STEERING CONTROL: steadiness and coordination	Fair 72	Fair 84
SPEED OF REACTION: responding quickly	Fair 70	Average 98
FIELD OF VISION: slower to left stimuli	** -319	Fair 76
ADJUSTING: quickly and easily to changes	** 4	Fair 84
SELF-CONTROL: resisting the urge to act quickly	Fair 80	Average 100
CONSISTENCY: driving in the same way	** -239	Average 100

-----  
 The 'SELF-APPRAISAL' column reflects how you predicted you would do.  
 Your 'PERFORMANCE' rating is based on how you did compared to the scores  
 we obtained from a group of xxx licensed drivers from 18 to 80.

An 'AVERAGE' rating ranges from 85 to 115.  
 \*\* Below 70 is UNACCEPTABLE: very few safe drivers score that low.

-----  
 AVERAGES: Performance= xxx Self-Appraisal= xxx DSRWHEN= (Not done)  
 PERFORMANCE VS SELF-APPRAISAL(PSA) INDEX: -131 (\*\* BELOW self-estimates)

Your 'PERFORMANCE VS SELF-APPRAISAL INDEX' tells whether you did as well as  
 you thought you would. Your low PSA index (-131) indicates that your  
 confidence greatly exceeds your abilities.  
 -----

ELEMENTAL DRIVING SIMULATOR: Data Sheet

DESIGNED BY: ROSAMOND GIANUTSOS PROGRAMMED BY: AARON BEATTIE  
 (C)1992-1995 LIFE SCIENCE ASSOCIATES VER #: 71597 FOR IBM COMPATIBLES

"ALHD" (Aware Left Hemianopic Driver) DATE: 06/16/94 10:30:00  
 BORN: xx/xx/xx Annual mi.: 10000 Violations: 0 MV Crashes: 0  
 Reference Group: xxx licensed drivers from 18 to 80 COLORED SIGNALS  
 S/P CEREBRAL HEMORRHAGE 1/94 W L HOMONYMOUS HEMIANOPIA

STEERING										
P H A S E	SCRAPES		CRASHES		(--DEVIAION--)			LENGTH	TIME	ELECTIVE
	N	mi.	N	mi.	MEAN	ST DEV	WOBBLE	(mi.)	ON	TIME
1	4	8.03	1	2.01	-0.81	1.19	0.43	0.50	1.04	0
2	49	32.75	12	8.02	-0.46	1.53	0.53	1.50	3.13	0
3	49	23.57	8	3.85	-0.10	1.58	0.48	2.08	4.34	0

REACTION TIME (SEC)

Phase 2: WATCHING FOR FRED

	LEFT	RIGHT	BOTH	(R - L)
COUNT	(10)	(10)	(20)	
MEAN	1.89	0.71	1.30	-1.18
MEDIAN	1.41	0.69	0.77	-0.72
ST. DEV	1.44	0.10	1.16	
ERRORS	0.00%	0.00%	0.00%	
MISSES	10.00%	0.00%	5.00%	

Phase 3: HAZARD AVOIDANCE

	LEFT	RIGHT	BOTH	(R - L)
COUNT	(10)	(10)	(20)	
MEAN	2.98	1.40	2.19	-1.59
MEDIAN	2.97	1.40	1.77	-1.57
ST. DEV	1.08	0.41	1.14	
ERRORS	20.00%	10.00%	15.00%	
MISSES	10.00%	0.00%	5.00%	

NORM-REFERENCED SUMMARY: Self Appraisal = ? Actual Performance = 0

	est.	actual	LIMIT*(70)	AVG*(100)
STEERING CONTROL:	84	72	-----O-----?	-----?
SPEED/REACTION:	98	70	-----O-----?	-----?
FIELD OF VISION:	76	-319	-----?-----	-----?
ADJUSTING:	84	4	-----?-----	-----?
SELF-CONTROL:	100	80	-----O-----?	-----?
CONSISTENCY:	100	-239	-----?-----	-----?

PERFORMANCE VS SELF-APPRAISAL(PSA) INDEX: -131 Performed \*\* BELOW self-estimates

SA Avg: xx.xx EDS Performance Avg: xx.xx DSR 'WHEN' Avg: (Not Done)

Time (min:sec) Practice 12:30 Test 8:31

Patient's notes: 'SHOULD KEEP THE FACES IN SIGHT BETTER'

## **Case Example 2: Complex Traumatic Brain Injury with extended neurobehavioral rehabilitation**

Neurobehavioral (NB) survived a head-on collision with multiple trauma, including orbital and skull fractures and massive brain injury. He was evaluated and treated with an individualized technology-augmented cognitive rehabilitation program, in which driving was an important, but by no means the only component. By the time he was first seen a year post onset, he was ambulatory and expressed (solo and a capella) great confidence in his ability to drive. His family did not trust his judgment to stay at home alone for anything other than short intervals and he was totally dependent on others to drive him where he needed to go. It never ceases to amaze us how often people who are not safe in crossing the street on foot (or in a wheel chair) seek to drive. Initially, NB's obsession with driving was directed to mobility on foot and public transit. With supervision and safety awareness training to become independent on the train. This achievement was psychologically uplifting and he continues to use this mode of travel on longer trips, especially into urban areas.

NB would have angry outbursts and poor frustration tolerance. On each such occasion he would attest to having learned his lesson, that the problem would not occur again. He was persuaded that he had to earn the confidence and trust of others – that his own confidence was not sufficient, as his judgment was always to be “optimistic” rather than realistic. He agreed that he would have to remain outburst free for at least three months before he could expect others to find him sufficiently trustworthy to even consider assessment for resumption of driving. It took him 9 months to achieve reach this goal.

NB had significant attentional problems (e.g., with simultaneous information processing and mental flexibility), binocular dysfunction (affecting depth and other forms of visual perception), impulsivity and visual agnosia (failure to recognize some objects in his direct line of sight). These problems were addressed in his cognitive rehabilitation and optometric treatment programs. Some exercises were identified for their specific relevance to skills needed for safe driving, for example, visual closure. These exercises showed him concretely the standards which he needed to meet and demonstrated that others were taking his goal of driving again seriously.

Throughout this time, the clinician's observations of NB's reasoning and behavior were complemented by information offered by family members and other professionals. It was clear that much improvement was needed before NB would garner family support for his driving. Formal pre-

driving assessment was initiated gradually and explicitly made contingent on achieving consistently acceptable behavior and judgment.

Since NB was under optometric care, formal vision screening was not needed; however, his binocularity problems were identified as potential issues for judgment of distances, e.g., following and stopping. His visual perceptual agnosia was characterized as a “look no see” problem, regularly brought to his attention in whatever contexts it occurred, and explicitly related to driving, e.g., “gee, Officer, I didn't even see him...”

Formal assessment of judgment and information processing abilities related to driving was accomplished with the Elemental Driving Simulator. On this rudimentary computer-based simulation, performance relative to a norm group of drivers is compared to self-appraisal. NB predicted that he would score average or better on all scales; however, it took him four attempts, separated by at least a month, to attain scores on all subscales within two standard deviations of the mean – a clinical cutoff corresponding to the 2nd percentile.

An on-road behind-the-wheel assessment was then scheduled and as it happened NB was observed by two experienced Driver Rehabilitation Specialists (DRS), one of whom recommended further Cognitive Rehabilitation and the other thought it was time to begin driving lessons. Although he had already made great progress, NB was still a marginal candidate for driving. Once authorized by his insurance carrier, NB began lessons with a local commercial driving school instructor who was experienced with drivers with disabling conditions. As coordinating DRS, I (RG) observed the first lesson, which also served as an independent evaluation, and remained in close communication with the driving instructor. After two months of lessons, the instructor encouraged NB to begin practice driving. His family was not eager to work with him in this regard and NB was to obtain his own car, insurance and satisfy legal requirements (his license, by now, had expired and he had to notify the licensing authorities of his condition and obtain medical clearance to continue driving. He obtained an oversized center-mount rearview mirror.

His practice and guidelines for driving now came into my direct oversight as DRS. The following system remained in effect for approximately one year before NB achieved a modicum of meaningful independence in his driving.

1. Driving log: NB was to record each trip, including time, distance, objective and observations.
2. Monthly observation drive: The itinerary for this two hour drive was proposed by NB based on where he wanted to go and felt was within his capabilities. Initially, over half the proposed

routes were determined to be unsafe, usually because of traffic density and left turns. This method worked especially well as it gave NB opportunity to demonstrate his advancing appreciation of factors which impact on the safety of different routes. He learned how to use route planning to reduce risk. Computerized local street maps were helpful in this planning, both for NB and the DRS, who was not particularly familiar with NB's community. Over the months, the list of approved routes grew.

- NB agreed to limit his driving strictly to daytime driving along approved routes. He adhered to these guidelines quite consistently, and there were no serious mishaps and only one lapse in which he drove some friends at the day center to lunch.

For a year NB's driving consisted of observed drives and limiting himself to approved routes. Because he showed excellent progress, he was given leeway to select his own routes within ten miles from home. Since his depth perception continued to impact his judgments of gap and following distances at night, night driving was proscribed. A year later, we scheduled a nighttime drive and he demonstrated sufficiently improved skill that the DRS felt comfortable relaxing the night driving restriction. NB's wife never clearly endorsed his driving, a fact which continues to frustrate him; however, she stopped objecting. NB has now put over 100,000 safe local miles on his car. It has allowed him to resume part time work and to pursue avocational and social activities.

Name: ***TBI Survivor***      Date of Birth: ***/ /38***      Date of Test: ***/ /93***  
 Annual miles: ***24000***      Violations: ***0***      Accidents: ***1***

Reference Group: ***Drivers of working age.***

AREA	PERFORMANCE	SELF-APPRAISAL
STEERING CONTROL: steadiness and coordination	<i>Fair</i> 76	<i>Average</i> 100
SPEED OF REACTION: responding quickly	<i>Fair</i> 78	<i>Average</i> 100
ADJUSTING: quickly and easily to changes	<i>Average</i> 97	<i>Average</i> 102
SELF-CONTROL: resisting the urge to act quickly	<i>Average</i> 90	<i>Average</i> 100
CONSISTENCY: driving in the same predictable way	<i>Fair</i> 77	<i>Average</i> 100

The 'SELF-APPRAISAL' column reflects how you predicted you would do. Your 'PERFORMANCE' rating is based on how you did compared to the scores obtained from a group of drivers of all ages.

An 'AVERAGE' rating ranges from 85 to 115.  
 \*\* Below 70 is UNACCEPTABLE: very few safe drivers score that low.

PERFORMANCE VS SELF-APPRAISAL (PSA) INDEX: ***-16.80 (BELOW self-estimates)***

Your 'PERFORMANCE VS SELF-APPRAISAL INDEX' tells whether you did as well as you thought you would. ***A negative PSA index means you were over-confident.***

### **Case Example 3: Concerned Older Driver**

This 87 year old gentleman saw a letter to the editor in the New York Times regarding the availability of cognitive assessment for driving advisement. Independently, he tracked down the information, arranged and paid for the assessment which was done in his home. His daughter observed the process and endorsed her father's general mental status, e.g., "that's why Daddy's doctors have not advised him against driving -- they all know he drives." He prepared a detailed neatly printed synopsis of his medical condition.

He stated that he particularly enjoyed driving approximately 20 miles on suburban parkways and local roads to take his girlfriend out to lunch on the weekend. However, in bad weather, e.g. it had rained heavily on the previous day, they would drive to a nearby restaurant. His results and my recommendations follow:

Elemental Driving Simulator: Personal Report

Name: ELDR, DRIVING      Date of Birth: 01/10/11      Date of Test: 12/28/97  
 Annual mi.: 4000      Violations: 0      MV Crashes: 0  
 Reference Group: 135 licensed drivers from 18 to 80  
 CONCERNED OLDER DRIVER

AREA	PERFORMANCE	SELF-APPRAISAL
STEERING CONTROL:	**	Average
steadiness and coordination	40	100
SPEED OF REACTION:	**	Average
responding quickly	31	94
FIELD OF VISION:	**	Average
slower to left stimuli	63	92
ADJUSTING:	**	Average
quickly and easily to changes	-18	108
SELF-CONTROL:	**	Average
resisting the urge to act quickly	57	100
CONSISTENCY:	**	Average
driving in the same way	-45	100

The 'SELF-APPRAISAL' column reflects how you predicted you would do. Your 'PERFORMANCE' rating is based on how you did compared to the scores we obtained from a group of 135 licensed drivers from 18 to 80.

An 'AVERAGE' rating ranges from 85 to 115.

\*\* Below 70 is UNACCEPTABLE: very few safe drivers score that low.

AVERAGES: Performance= 21.33 Self-Appraisal= 99.00 DSRWHEN= 87.71

PERFORMANCE VS SELF-APPRAISAL(PSA) INDEX: 17 (\*\* BELOW self-estimates)

Your 'PERFORMANCE VS SELF-APPRAISAL INDEX' tells whether you did as well as you thought you would. Your low PSA index (17) indicates that your confidence greatly exceeds your abilities.



-----  
NORM-REFERENCED SUMMARY: Self Appraisal = ? Actual Performance = 0  
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	est.	actual	LIMIT*(70)	AVG*(100)
STEERING CONTROL:	100	40	-----? -----	-----? -----
SPEED/REACTION:	94	31	-----? -----	-----? -----
FIELD OF VISION:	92	63	-----0 -----	-----? -----
ADJUSTING:	108	-18	-----? -----	-----? -----
SELF-CONTROL:	100	57	---0 -----? -----	-----? -----
CONSISTENCY:	100	-45	-----? -----	-----? -----

PERFORMANCE VS SELF-APPRAISAL(PSA) INDEX: 17 Performed \*\* BELOW self-estimates  
SA Avg: 99.00 EDS Performance Avg: 21.33 DSR 'WHEN' Avg: 87.71  
Time (min:sec) Practice 24:43 Test 7:55  
Patient's notes: 'I WAS CONFUSED ABOUT THE REDS AND GREENS'

Recommendations for Mr. Eldr:

1. On every scale, most licensed drivers (97% or more) perform better than you. While you are probably comparable to those of your age peers who are still driving, these low scores suggest a significant increase in your risk. You report that you have limited your driving and you express laudable concern about your safety as a driver. It is time to recognize that it would be safer if you found other people to drive and to reorganize your life so that you can manage without driving. The issue for almost every older driver is not whether to stop driving, but when and how.

2. Should you continue to drive, you need to limit your mileage, especially to avoid high traffic areas. Your greatest difficulties (relative to other drivers) on this simulation occurred when task demands became more complex.

3. Some practical suggestions:

a. A wide angle mirror which fits on top of your center-mount rearview mirror will help you compensate for restricted range of motion in your neck.

b. It is often possible to find young people who will drive you in your car for a reasonable price at scheduled times.

c. Consider the savings in insurance and gas if you sell your car: allocate these funds for car service.

4. Medical factors which could affect your driving safety and should be investigated further:

a. Visual fields. Since you are at some risk for glaucoma, you should ask your eye doctor to do a visual field test and to address the issue of whether your fields meet the standards for driving (140 degrees in the horizontal meridian).

b. Neuropathy in your feet: This could affect the reliability with which you operate the foot pedals, especially the brake in an emergency. You wear thick soled shoes, which may reduce your pedal awareness further.

c. Episodes of dizziness: You estimate that these are occurring about once a week and that when they have occurred while you are driving, you pull off the road to let it pass. Although this problem is, apparently, not new, it may be getting more frequent. The fact that you have managed to drive safely with this condition may be as much a matter of luck as how you deal

with it.

# Further Clinical Examples from the DAS

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These examples are offered because of their clinical interest - because of the issues raised and ways of addressing them.

**NAME: L Hemianopic      GROUP: Traumatic Brain Injury      EXAMINER: RG**

“L. Hemianopic” (LH) was given the DAS because he was to conclude an inpatient stay during which he had progressed remarkably following his head injury and was becoming ambulatory. He was voicing a strong desire to resume driving and it was likely that he would have physical access to a vehicle upon his immanent return home. So, even though no one else thought he could resume driving safely, and his visual field deficit was sufficient to preclude his meeting the minimum legal requirements for licensure in most states, it was felt that driving advisement was necessary. The DAS allowed us to demonstrate and discuss the problems with him and his family. We confirmed the family’s suspicion that it would be necessary to prevent him from driving and to make other provisions for mobility.

## SUMMARY

- AREAS OF CONCERN
  - A. Left hemi-imperception, i.e., decreased responsivity to stimuli on the left side.
  - B. Judgment: unrealistic self-appraisal
  - C. Slowed information processing
  - D. Distractable - subject to self-generated distractors
  - E. Fatigue
  - F. Poor pedal / position sense
- STRENGTHS
- RECOMMENDATIONS
  - A. Not yet ready to pursue driving at this time.
  - B. Work on therapies to address the above concerns.
  - C. Future plans, e.g., vocational, living arrangements, should not be dependent on his being able to drive.

1. THE DRIVING ADVISEMENT SYSTEM IS INTENDED FOR USE BY CLINICIANS CHARGED WITH EVALUATING AND ADVISING INDIVIDUALS CONCERNING THEIR POTENTIAL FOR SAFE DRIVING.

2. IT ADDRESSES ONLY ON ASPECT - COGNITION - OF SAFE DRIVING. COMPREHENSIVE PRE-DRIVING ASSESSMENT MUST ADDRESS OTHER DOMAINS, INCLUDING NEUROLOGIC, MOTORIC AND SENSORY FUNCTIONS, ESPECIALLY VISION.

3. NO ONE CAN GUARANTEE THAT AN INDIVIDUAL WHO DOES WELL ON THESE TASKS WILL BE ACCIDENT-FREE, AND NO SUCH ASSURANCE IS IMPLIED BY A FAVORABLE RECOMMENDATION.

4. THE DEPARTMENT OF MOTOR VEHICLES OF THE STATE OF LICENSURE HAS THE EXCLUSIVE AUTHORITY TO GRANT AND WITHDRAW DRIVING PRIVILEGES.

**A. AREAS OF CONCERN**

1. Steering. GA used his right upper extremity only, as he has a significant tremor in his left arm, rendering it unable to serve even to steady the wheel. Even so it was necessary to adjust the tension on the wheel so that it was very "heavy." Nevertheless, he had difficulty controlling the wheel smoothly, sometimes overcorrecting and undercorrecting. *On a few occasions when there was a need to turn in one direction, he would turn in the opposite direction. These tendencies could be disastrous in a sensitive wheel; while they might be tolerable with a highly "forgiving" one.*

2. Mental processing efficiency. As the tasks became more complex, GA's performance deteriorated more than we usually observe. His reaction times on the visual field screening were about .10 sec greater than expected.

3. Inconsistency was noted on dynamic visual field screening without a clear pattern. It was possible to distract him with conversation, especially as he seemed to need to compensate for his hearing impairment by lip-reading.

4. Pedal control was fair and should be observed in on-road in-vehicle testing.

5. Changing visual status associated with vertical imbalance (right hyperphoria) and double vision at times. Squinting, or otherwise occluding, one eye would correct this problem, but will introduce a new problem - impaired spatial sense. It is important for GA to appreciate the consequences of this. It might be enlightening for him to have some supervised driving with one eye covered intentionally.

6. *Changing medical status. GA may have Parkinson's, a "progressive" disorder. If he does, he has to realize that the question is not whether he should abandon driving, but when he should do so. It will be important for him to establish objective guidelines to signal the need for re-evaluation or discontinuing driving.*

**B. STRENGTHS**

1. *GA is an experienced driver and continues to have an appreciation of safety issues. His own experience and good record as a driver give him a good foundation for resuming driving.*

2. *GA is conscientious and receptive to input from others regarding the advisability of his driving.*

3. *Driving is an option, not a requirement, for him. He is both willing and able to limit himself to times and circumstances in which he is most likely to be safe.*

4. GA is a quick learner and would capitalize on using his intellect to drive defensively and reduce his exposure to risk.

5. His endurance appears to be good. Fatigue would not compromise his driving ability.

**C. RECOMMENDATIONS**

1. Not yet ready to resume independent driving. His impaired mental processing speed, steering are problems which could significantly increase his risk.

2. Rehabilitation-oriented specialized on-the-road examination. Before resuming driving, it is important that GA pass a road test given in a facility which is experienced in assessing the capabilities of persons who have had acquired brain injury, including stroke. One such facility is at ....

3. Defensive driver course. Although GA has good safety awareness, it would be helpful for him to have a defensive driving refresher course. These courses are offered around the state, e. g., National Safety Council (800-962-3434), National Traffic Safety Institute (800-334-1441), American Association of Retired Persons, AAA.

4. Supervised driving. When ready to resume driving, GA will need to practice, at first with a licensed driver educator in a vehicle with dual controls. Mr.        at        might be helpful.

5. Vehicular modifications might be helpful, especially an adjustment on the tension of the steering wheel and a spinner knob.

#### IV. SUMMARY (DAS)

##### B. AREAS OF CONCERN

1. **Judgement.** FS's self-appraisal is that her current abilities are high and essentially unaffected as a result of the head injury. After the assessment, her evaluation of herself remained unchanged. Until she can recognize and acknowledge problem areas, she is unlikely to even attempt to deal with them. Her judgement about potential hazards and the need to limit her driving, at least initially, would seem to be nil, or at least very poor. She did not see the implications of her problems for safety and did not even give lip service to these issues, maintaining throughout that her need to drive is her only consideration.

She described herself as a fast driver, and gave no indication that she would even consider changing this style.

2. **Autoregulation.** She seems unable to slow herself down in order to maintain the quality of performance. When the assessment tasks became complicated, she continued to respond relatively quickly and made many errors (e. g., 35% when the median and upper limit of the comparison group are 2.5% and 12.5%, respectively), and was relatively unfazed ("Oops, wrong pedal").

3. **Mental inflexibility.** She had great difficulty adjusting to changes in circumstances. She understood the rules quickly, but did not always notice when signals had changed. Perseveration contributed to her high error rate, and was especially noticeable when fatigued.

4. **Pedal control.** I had to draw her attention on several occasions as to the placement of her foot on the pedal, and there were many times when her pedal press would not register adequately (this after much practice).

5. **Mental processing efficiency.** As the tasks became more complex, FS's performance deteriorated more than we usually observe.

6. **Vision.** Having reviewed the optometrist's reports and FS's records in her cognitive treatment, I am concerned that she understands how her visual problem will affect her driving. The basic problem is that there is little useful vision in her left eye, since the head injury. *She is functionally a one-eyed driver. There are three implications: (a) a reduction of the overall field from approximately 170 degrees to 140 degrees, especially on the extreme left side. (b) a blind spot, corresponding to the physiological blind spot, somewhat to the right of, and slightly below, center. Usually, the other eye provides input to this area. If she is holding her gaze steadily on the road ahead, she might not notice a pedestrian or a cyclist at the side of the road. (c) Most significant, her appreciation of spatial relations - previously derived from the use of binocular cues - will have to be based solely on monocular cues. This will require some adjustment and there are times where she may do worse than others, e. g., at twilight, on a dark night, etc. She will be more vulnerable to rear-end collisions and stopping either too soon or too late when entering an intersection.*

##### C. STRENGTHS

1. FS is an intelligent woman who, I think, can figure out what accommodations she will need to make in order to drive safely.

##### D. RECOMMENDATIONS

1. **Not yet ready to resume driving.** FS is certainly not far enough along in her recovery to drive safely. Much of my concern derives from her lack of insight and appreciation of social responsibility in driving. Her impaired autoregulation (self-control), perseveration and mental inflexibility will make her unsafe.

2. Rehabilitation-oriented specialized on-the-road examination. Before resuming driving, it is important that FS pass a road test given in a facility which is experienced in assessing the capabilities of persons who have had head injuries. One such facility is at the xxx Institute of Rehabilitation. The usual procedure is to contact xx, MD, for

an examination prefatory to scheduling the road test (which is administered under the auspices of the Physical Therapy Department there).

3. Defensive driver course. These courses are offered around the state, e. g., National Safety Council (800-962-3434), National Traffic Safety Institute (800-334-1441), American Association of Retired Persons.

4. Counseling to address the issues raised under "Judgement" above. Especially if offered at the same time as the Defensive Driver course.

5. *No alcohol or other mind-altering substances when driving. FS's cognitive deficits from her head injury impair her ability to overcome the adverse effects of such substances.*

6. Supervised driving. When ready to resume driving, FS will need to practice, at first with a licensed driver educator in a vehicle with dual controls. Essentially I would recommend that she be issued a restricted license, equivalent to a learner's permit.

IV. SUMMARY (DAS)

B. AREAS OF CONCERN

1. Judgment and appreciation of safety issues. Mr. Youth did not have an appreciation of his own limitations and their implications for his ability to drive safely. Without such an appreciation, he cannot be expected to exercise appropriate caution and judgment. Furthermore, his comments generally showed little concern for safety and his responsibilities to others in this regard. He expressed limited concern for legal obligations and did not seem to understand the importance of having insurance.

2. Mental processing efficiency. When the tasks became complex, Mr. Youth's performance declined noticeably, more than we usually observe.

3. Mental inflexibility and impulse control (autoregulation). He had great difficulty adjusting to changes in circumstances. This was especially noticeable in the difficulty which he had learning the procedures.

4. Inconsistency. Mr. Youth responded inconsistently. Some of this variability may be caused by fatigue. However, attentional factors seem likely to contribute, at times he would just not notice important signals in predictable locations.

5. Inexperience. Mr. Youth has never had a driver's license, although he claims to have driven considerably since he was 15. He has had no driver training.

6. Motor incoordination was a problem when Mr. Youth attempted the steering task. He may perform better with adaptive equipment, such as a spinner knob, and with non-power steering.

C. RECOMMENDATIONS

*General: This examiner must admit to a lack of enthusiasm about the prospect of Mr. Youth's operation of a motor vehicle in the near future because of his cognitive deficits and his minimal appreciation of them. These problems, together with his history of driving without a license, registration or insurance, raise the issue of whether he will show judgment or concern for safety. On the other hand, if he is not educated and the matter is not pursued in a therapeutic context, he may attempt to drive anyway and be an even greater risk.*

1. Not yet ready to begin on-the-road training. His impaired mental processing speed, poor autoregulation (self-control), inability to sustain attention consistently, lack of endurance and poor motor control in combination present too great a risk.

2. Psychological counseling specific to the issues of self control and responsibility for safety. A realistic self-appraisal must be developed as a foundation for judgment.

3. Treatment to address issues of processing speed and autoregulation. At this point in time, I am not sure much can be done to get Unrestrained to be able to process information quicker without compromising the accuracy of his decisions. However, practice with feedback would help him determine if this can improve and if not might contribute to a more realistic self-appraisal and necessary accommodations.

4. Specialized driver evaluation and training program. When Mr. Youth is ready to pursue driving, then he should do so through a head injury rehabilitation facility with an on-the-road driving program where they can prescribe whatever adaptive equipment would be necessary.

Legally, he must first notify the Department of Motor Vehicles of his having had a head injury and seek a learner's permit to drive under supervision. Practice driving can then be considered; however, it should still only be done with a licensed driver educator in a dual controlled vehicle.

5. Defensive driver course and other off-road educational experiences. Safety awareness might be enhanced through education and self-study. One approach would be to take a defensive driving course. These courses are offered around the state, e. g., National Safety Council (800-962-3434), National Traffic Safety Institute (800-334-1441), American Association of Retired Persons.

# Perfield: Functional Visual Fields / Peripheral

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## Summary

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Practical procedures for assessing peripheral visual awareness, esp for driving. REACT and SDSST parallel formal visual field assessment procedures. SOSH & SEARCH increase information density, eliciting hemi-inattention ('neglect').

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Brain injuries can cause insidious gaps in the visual "fields" - insidious because, more often than not, a person with visual field losses is unaware of the problem. Just as people with hearing losses sometimes feel that others are mumbling, people with visual field losses may actually feel that the world has changed, e.g., why are they making clocks that way?

People without brain injuries, who think they are seeing everything, may be shocked to learn that they too have gaps in their vision. Known as "physiological blind spots" these gaps are caused by the lack of sensory receptors where the nerve leaves the eye to carry visual information to the brain. You have one in each eye, about the size of a fist at arm's length. Close one eye and try to locate yours. Is it on the inside or the outside? In each eye it is located a little to the outside and slightly down from where you are looking. If -- like most people -- you don't feel this blindness, try the demonstration below.

People with gaps in the visual fields caused by brain injury, therefore, may have a double disability: the loss of vision and the loss of awareness. Normally, the nervous system tends to fill in the background and to lose the figure. So if such a person were to attempt to drive (not recommended!), they might see the road, but not a pedestrian or child running into the street.

Brain injury can cause different patterns of loss, including blind spots and tunnel vision. However, most common is a pattern called "homonymous hemianopia" in which corresponding halves of the fields are lost in each eye. For instance, in left homonymous hemianopia the blindness affects the left side of each eye. The blindness may be absolute (complete) or relative (reduced sensitivity).

It is not easy to test for visual field losses, especially if there are cognitive problems caused by the brain injury. And since people are often unaware of the loss, it is quite possible that the losses will remain undiagnosed. Fortunately, our computerized methods have been developed to check for visual field impairment. Because these techniques offer immediate feedback, they can be used to build awareness and to lay a foundation for treatment.

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Blind Spot Demonstration

---

---

L

R

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Instructions for Blind Spot Demonstration

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1. Hold at arm's length.
2. Close your left eye and
3. Look at the L with your right eye.
4. Slowly bring the sheet towards you,.
5. Keep looking at the L, but notice what happens to the R.
6. At some point you will realize that the R is no longer visible.
7. Keep moving the paper closer and the R will reappear.
8. Repeat the process with the other eye.

Notice: Although the letter disappears, the paper does not. This phenomenon is known as the completion effect. The brain fills in gaps in the visual field with predictable patterns or surfaces.

## REACT : Reaction Time Measure of Visual Field

-----  
Detects slowed response to visual stimuli in all quadrants of the display.  
Respond w switch/joystick or mouse (requires DOS mouse driver) button.  
Accurate (machine-speed independent) response times mapped in patient  
comprehensible display.

=====  
Purpose  
=====

This procedure can be used to detect slowed response to visual stimuli-either on the right or left side or both sides, as well as the top, middle, and bottom. With eyes free to move, the procedure is a 'functional' visual field, more like everyday life than conventional visual field measurement which involves fixation. Immediate response time feedback is reinforced by the final results, which include a map of response speed to stimuli in various parts of the visual field. This feedback, unlike any traditional visual field measurement procedure, offers the patient information which may improve awareness of, and ultimately insight into, their sensory loss.

=====  
Materials  
=====

### Response Key:

The left mouse button, joystick 'fire' button, or a switch connected to an interface for the joystick/game socket. Must be easy to activate and reliably positioned so that the patient can respond as quickly as possible.

The ENTER key is used to interrupt trials. This option is NOT announced on the test screen, which must remain clear.

=====  
Procedure  
=====

In this program, the patient simply presses the mouse or joystick button to "stop the runaway numbers" on the screen. The quicker the button is pressed, the better the score will be. The computer keeps track of where on the screen the stimuli (numbers) were and the reaction times. Settings can be adjusted so that there is a fixation point or, without one, the patient may look anywhere on the screen.

You may choose the mouse button or joystick button as the response key. Note that with a switch interface, you may use almost any momentary contact switch. The 'Response' key = mouse button, the joystick 'fire' button, or a switch plugged into an interface box. When using a mouse, you must have DOS mouse software installed - often by running MOUSE prior to running STARTCOG. Check with your local computer guru, if you don't know what this means.

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When you select REACT from the program menu, you will be given an opportunity to designate the ATTRIBUTES OF RESPONSE KEY #1 (Don't worry, there is only one.) If the supplied information is not correct, type N in response to the IS THE INFORMATION CORRECT? You will then be given choices pertaining to the attributes listed on the screen. Some of these are subjective. For example, if you are using a mouse button, you might use the following:

SITE: FINGER  
MOVEMENT: FLEXION  
EFFORT (FORCE): EASY  
TYPE OF SWITCH: BUTTON  
MOUNTED ON: MOUSE

If you would like to change the wording, you may select OTHER and type in your change in the space offered - you will have to be succinct. Your description of the response key will be included on the printout and saved with the data. The description you enter will, however, not change the operation of the program.

TEST YOUR RESPONSE KEY - Before the task begins, the computer needs to know what will be the response key: At this point have the patient press the button you plan to use: either the left mouse button, the joystick "fire" button or a switch. If everything is in order, the press will be confirmed and you can press ENTER to proceed.

What could go wrong at this point? The computer attempts to determine if a mouse or switch is available and set up properly (usually a software 'driver' program has to be run, often automatically when your computer is turned on). If you are not computer literate, you may need to have your computer technician help out. If you are using a mouse, there must be a DOS mouse driver installed. Just because there is a mouse and it works in Windows, does not mean that there is a DOS driver installed. The mouse has to be set up so it will work in DOS programs. Similarly, if you are using the Notebook Gameport, there is a program NG which must be run prior to STARTCOG. Again, your computer technician ought to be able to set these programs up so that they are run automatically and you don't have to think about them any more.

#### SETTINGS

The settings are described in detail below. You are offered the settings which were last used. If you type A to accept the settings, you can proceed quickly. If you would like the standard (initial) evaluation settings, press R to Reset, then A to Accept the settings and proceed. Finally, if you wish to change a setting, press C to Change. You will go through the settings one-by-one. Press ENTER to retain a setting, or follow the screen instructions to modify.

#### INITIAL COMMENTS

You are given two lines in which you can type comments. This may include special conditions, such as type of glasses worn, specific instructions, current medications, etc. Patient remarks are often illuminating. Avoid

---

using quotation marks (single quotes are ok).

Comments are optional. Press ENTER when you are ready to proceed.

READY to begin?

Press ENTER when ready to proceed. If you set the "Trials started by ..." to "UNWARNED" (see Settings below), trials will continue at random intervals. You can press ENTER again to interrupt them. This option is "hidden" - there is no prompt on the screen, since in REACT it is important to have a clear screen. You might want to press ENTER and interrupt the trials in order to explain something to the patient, to adjust the switch placement, to erase an invalid trial, or to exit the procedure altogether. After you press ENTER, you will be given options to select.

The first two trials of REACT are considered practice and are not counted. If you interrupt the practice trials, you will not be given the option to Erase or Exit the task. Complete the practice trials before attempting to exit.

Typically, REACT should be run several times in an evaluation: each run takes about 2.5 mins. First, repeating the procedure is the best way to clarify any ambiguity or inconsistency in the findings. Second, one should systematically investigate factors, such as

Eyes free to move vs. Eyes fixated

=====

This factor gives information about how well the individual uses eye movements to compensate for the loss

Normal viewing contrast vs. Low contrast

=====

This factor can reveal 'depressions' (reductions or relative losses) in the visual field. Not all impairments are absolute, as is connoted by the term field 'cut'. Reduced contrast can be accomplished subjectively by reducing the contrast setting on the computer monitor, e.g., turn it down so that the patient just barely can see the print, then turn it up slightly. A standardized reduction of contrast in REACT is accomplished using Life Science Associates' Contrast Reduction Spectacles. Be sure to note in the comment section which condition is being used.

Without distraction vs. With distraction (verbal)

=====

While the formal visual field is not supposed to be influenced by attentional factors, in the real world visual response may be markedly affected by inattention. In recent years the concept of "Useful Field of View" has become very useful, especially in clarifying the constricted visual awareness of some older drivers.

The sensitivity of REACT in measuring reaction time gives an opportunity for unprecedented mental chronometry: Just a fleeting thought will cause one's "number" to go up by 10 or 20! (.10 to .20 sec). Actually, in studies of distraction with college students, Matheson found

increases were limited to about .20 sec. overall. Clinically, some patients show large increases with distraction.

Incidentally, the best distraction is having the person answer questions promptly about personal information of special concern.

Binocular vs. Monocular

=====

Monocular fixated fields most closely parallel formal visual field measurement procedures. If both eyes exhibit losses in the same locations, the pattern is "homonymous." Homonymous visual field losses suggest neural injury beyond the optic chiasm in the visual pathways.

If these losses include the entire left or right half, then it is "hemianopic." (Hence, the term "homonymous hemianopia." Incidentally, "hemianopsia" is a variant of "hemianopia" and experts vary on which is "correct," but some people have strong views on the matter.

Losses limited to a quarter of the visual field are "adranatopic." A blind spot, surrounded by intact vision, is called a "scotoma." Every neurologically normal eye has a "physiological blind spot" or scotoma corresponding to where the optic nerve leaves the retina. This is "temporal" (on the outside, not the nasal side) about 1/8 th of the distance off center (12 to 20 degrees of visual angle) and about the size of a fist at arm's length. There is a complete and abrupt loss.

Dynamic vs. Stable

=====

This factor is poorly understood, but vision scientists recognize two major types of visual system - one of which is more tuned to dynamic information, e.g., changes in visual field, than to the presence or absence of a visual stimulus (stable/static information). In the real world, the visual field is often dynamic because the environment changes, but also the individual moves within the environment as well. In driving, dynamic fields are the usual state of affairs; stable fields would only be relevant when stopped, as at an intersection, reading a sign.

The stable vs. dynamic variable is offered as an interesting variable to explore. Clinical research is needed before firm conclusions can be drawn.

=====  
 Settings  
 =====

1...Attributes of Resp Key 1                      Default value: n/a

Finger / Flexion / Easy / Button / Mouse - Put fuzzy velcro spot on left mouse button ('Response' key). Patient must press the button reliably. Use dominant hand, unless injured.

2...Instructions                                      Default value: No

---

Instructions can be conveyed during practice. Stimulate the person to respond very fast. Erase practice trials or start over if you notice a warm-up effect.

3...Test Pattern Default value: STANDRD

Each pattern has .TST. STANDRD.TST is a butterfly shape. Also supplied are BGRING.TST. One can create other patterns, as needed.

4...Trial Started by Default value: UNWARNED

Rarely is this changed. Alternatives are CUED (trial is preceded by a warning signal) and EXAMINER STARTS trial

5...Mode of Testing: Eye(s) Default value: Moving freely

Moving freely is more 'functional' and allows person to compensate. It is cognitively easier and so is the best condition with which to begin. Alternative: FIXATED - This is most like conventional visual field testing procedures.

6...Eye(s) Tested Default value: Both

Both is more natural and recommended to begin with. Both would be contraindicated if person has diplopia (double vision). When testing with eyes fixated, you would use monocular mode: either LEFT or RIGHT eye.

7...TARGET Default value: DYNAMIC

Dynamic (standard) = numeric counter which advances very rapidly so that the pixels are moving and flashing continuously. Alternative (experimental): STABLE - a plus symbol appears and remains displayed until response is made.

8...Time to initiate response Default value: 2

Two seconds is useful in all but blatantly lethargic individuals, in which case one might go to 5 or at most 10 sec. If this is too long, people with field losses will wait long times for positive trials.

9...When time limit is exceeded: Default value: NoFeedback

Best for evaluations. There is always some feedback if the patient notices the number reached by the counter after each trial. With feedback, computer pauses between trials.

11...RESPONSE Default value: L Mouse

The left mouse key is usually easy for the patient to operate easily and reliably. Put a velcro dot on the L Mouse button to facilitate this.

=====  
 Results  
 =====

NOTE: If printed output was selected when you first started the COGREHAB programs, then

- (1) the printout will contain whatever is displayed on the screen.)
- (2) you may pause the display by pressing the <SPACE> bar. Freezing the display is useful for discussing the results with the patient

The REACT results includes:

Results screen 1: Response times by screen location.  
 The first display is a map of the response times to stimuli in different parts of the video display. Encourage the patient to review this chart when it is displayed at the end of the task.

NOTE: the information contained in this display is not preserved and saved in the disk data file. It is strongly recommended that you print and save it, even if you use the <PRT SCR> key to get a 'screen dump.'

Results screen 2: Quantitative summary.  
 (This information IS saved on the disk data file.)  
 The tables summarize response times for different portions of the display: Right vs. Left, Center vs. Periphery, Top vs. Bottom (least interesting). Mean (Average) and Median (middle-most) scores are complemented by minimum and maximum and the standard deviation (variability) of the response times. False alarms are also reported. If FA's are present, they may invalidate the response times - anyone can respond quickly by responding frequently without concern for responding at the correct time.

Results screen 3: a trial by trial bar graph of response times.  
 These bars are marked L or R to indicate what side of the display the trial was on. Practice and fatigue effects can often be seen on the trial by trial displays.

=====  
 Clinical Findings  
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Clinically, REACT is simple to understand and offers immediate feedback. To enhance the feedback message, some clinicians find it useful to have the individual scan the display of results for scores greater or equal to .4 sec. Ask them to count how many are on the left and how many are on

the right side. An occasional delay in responding may simply reflect a brief lapse of attention. Repetition is always in order before drawing any other conclusion.

REACT is very sensitive to verbal distraction and our data with college students showed that median reaction times with disctraction rarely exceeded .2 sec over the value expected without distraction.

When REACT is done with reduced visual contrast, one can diagnose partial reductions (relative field losses). Even with markedly reduced contrast, one would not expect reaction times to increase by more than .1 to .2 sec.

=====  
 Normative Findings  
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Most of the normative data come from college and professional school students. The primary dependent variable was the median or average reaction time on central, left and right side stimuli. Standard deviations ranged from .01 to .04 sec.

Young adult norms on eyes free to move with normal contrast respond consistently within .25 to .27 sec (Touro - R. Engle, C. Hall). These scores were maintained consistently over 6 trials of practice (NYU - R. Anand). Low contrast may add .10 sec (Touro - R. Engle) and verbal distraction about .20 sec. (Adelphi - Matheson). With eyes fixated, responding was about .05 sec. longer than with eyes free to move (Touro - N. Sidle).

Older (avg. age = 75 yrs.) persons (drivers, living at home) respond to central trials in about .32 sec with a standard deviation of about .05 sec (Touro - C. Hall). We do not yet have normative information for older persons' responses to peripheral stimuli.

Measure	Mean	StDev	Cutoff
=====	=====	=====	=====
REACT : Center average N = 20: 27.4 yrs	0.25	0.04	0.33
	Source: C. Hall		
REACT : Center average N = 20: 75 yrs	0.29	0.06	0.42
	Source: C. Hall		
REACT : Center, reg contrast N = 20: 22+23 yrs firefighters	0.24	0.01	0.27
	Source: R. Engle		
REACT : Center, low contrast N = 20: 22+23 yrs firefighters	0.35	0.04	0.43
	Source: R. Engle		
REACT : Center, fixated N = 20: 21-31 yrs students	0.25	0.04	0.33
	Source: N. Sidle		
REACT : Center, free to move	0.21	0.04	0.28

---

N = 20: 21-31 yrs students	Source: N. Sidle			
REACT : Center median		0.24	0.02	0.29
N = 20: 27.4 yrs	Source: C. Hall			
REACT : Center median		0.28	0.04	0.37
N = 20: 75 yrs	Source: C. Hall			
REACT : % False alarms		1.59	2.97	7.53
N = 20: 27.4 yrs	Source: C. Hall			
REACT : Left average		0.26	0.03	0.32
N = 20: 27.4 yrs	Source: C. Hall			
REACT : Left median		0.26	0.03	0.31
N = 20: 27.4 yrs	Source: C. Hall			
REACT : Left, reg contrast		0.26	0.01	0.28
N = 20: 22+23 yrs firefighters	Source: R. Engle			
REACT : Left, low contrast		0.38	0.04	0.46
N = 20: 22+23 yrs firefighters	Source: R. Engle			
REACT : Left, fixated		0.26	0.03	0.31
N = 20: 21-31 yrs students	Source: N. Sidle			
REACT : Left, free to move		0.20	0.03	0.26
N = 20: 21-31 yrs students	Source: N. Sidle			
REACT : Right average		0.26	0.03	0.33
N = 20: 27.4 yrs	Source: C. Hall			
REACT : Right median		0.25	0.03	0.30
N = 20: 27.4 yrs	Source: C. Hall			
REACT : Right, reg contrast		0.25	0.01	0.27
N = 20: 22+23 yrs firefighters	Source: R. Engle			
REACT : Right, low contrast		0.35	0.04	0.44
N = 20: 22+23 yrs firefighters	Source: R. Engle			
REACT : Right, fixated		0.26	0.03	0.32
N = 20: 21-31 yrs students	Source: N. Sidle			
REACT : Right, free to move		0.21	0.04	0.28
N = 20: 21-31 yrs students	Source: N. Sidle			

=====  
 Miscellaneous  
 =====

This program does not run under Windows. You must exit Windows completely, or, in Windows 95, set the properties of the shortcut to force the program to run in DOS mode with a maximized window.

The reason for this requirement is that this program involves precision timing which WINDOWS (an inherently timesharing/multitasking program environment) does not do well. We have opted to maintain the program's timing over the convenience of running in Windows. However, we regret this inconvenience and continue to seek a better solution.

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References  
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Variables Saved in \*.CUM Disk File  
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Note: The information below is for use in reading the saved data into a spreadsheet, such as Quattro Pro. With this information one can identify what each measure represents. These procedures are somewhat technical, but useful for comparing performance across sessions.

Seq	Variable	Description	I/D	Chrs	Example
1	TASK	PROCEDURE NAME	I	8	D REACT
2	NAME	LAST NAME	I	10	D DOE
3	1ST	FIRST INITIAL	I	1	D J
4	WHEN	DATE/RUN NO.	I	8	C 05079501
5	THGP	THERAPIST/GROUP	I	8	D RG\TBI

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6	INP1	INPUT (RESP) KEY 1	I	35	D	LEVER\MEDIUM\RFINGER
7	COMM	COMMENT	I	76	D	DIAGNOSIS/SPEC COND
8	INIT	INITIATED BY	I	1	D	U(=unwarned)
9	EYE	EYES TESTED	I	1	D	Left,Right,Both
10	FIX	FIXATED/MOVING FREELY	I	1	D	Fixated,Movingfreely
11	TIME	TIME LIMIT	I	3	C	2 (SEC)
12	PCTFA	FALSE ALARM PERCENT	D	4	C	
13	DIS	DISPLAY TEST PATTERN	I	2	D	
14	NC	N CENTER	I	2	C	5
15	NP	N PERIPHERAL	I	2	C	16
16	CAVG	CENTER AVERAGE	D	5	C	
17	TLAVG	TOP LEFT AVERAGE	D	5	C	
18	TRAVG	TOP RIGHT AVERAGE	D	5	C	
19	BLAVG	BOTTOM LEFT AVERAGE	D	5	C	
20	BRAVG	BOTTOM RIGHT AVERAGE	D	5	C	
21	TLMDN	TOP LEFT MEDIAN	D	5	C	
22	TRMDN	TOP RIGHT MEDIAN	D	5	C	
24	BLMDN	BOTTOM LEFT MEDIAN	D	5	C	
25	BRMDN	BOTTOM RIGHT MEDIAN	D	5	C	
26	CTIM	CENTER TIME	D	3	C	
27	TLTIM	TOP LEFT TIME	D	3	C	
28	TRTIM	TOP RIGHT TIME	D	3	C	
29	BLTIM	BOTTOM LEFT TIME	D	3	C	
30	BRTIM	BOTTOM RIGHT TIME	D	3	C	

## SDSST : Single and Double Simultaneous Stimulation

-----  
Stimuli are flashed on the left, right or both sides. Although fixation isn't required, the brevity of the display makes compensation difficult. Relative difficulty on simultaneous trials suggests "extinction" or "hemi-neglect."

=====  
Purpose  
=====

SDSST is one of the "PERFIELD" tasks for evaluating "functional peripheral visual fields." It represents an intermediate point in the spectrum of informational density / attentional demand: from REACT (the simplest) to SEARCH (the most complex). Bender used the classic confrontation procedure to test for the "extinction" phenomenon. This computerized procedure tests for extinction in the visual modality. The idea is to test for responsivity in both visual fields, presenting stimuli singly and, on other trials, two simultaneously. Extinction is said to occur when the individual responds to all single stimuli, but on double simultaneous trials fails to report one of the stimuli, usually the one which was on the affected side. Extinction is important because it suggests an attentional component to the hemi-field impairment, as opposed to a purely sensory loss.

=====  
Materials  
=====

Responses can be entered by keyboard (arrow keys) or mouse. The keyboard is more reliable. For evaluations it is suggested that the examiner make the entry; however, for repeated assessments or therapy, it is suggested that the patient learn how to enter responses.

After each trial, use the side and vertical arrows to bring the highlight (white box) to the response on the left and right side of the display. If the patient is verbal and the examiner is entering the responses, it is helpful to encourage the person to say what was seen on the left side before reporting what was on the right side, e.g., 'minus equals' or 'nothing equals.'

Check that the patient's response is shown on the display above the line, then press <ENTER>.

=====  
Procedure  
=====

In SDSST, on each subject-initiated trial, either (-) or (=) symbols may appear on either the left, the right, neither, or both sides. The subject indicates which occurred. Feedback is available at the examiner's option, and is useful for a therapeutic application.

The first two trials are written off to practice, although the

patient may not notice when the trial counter resets after two trials. If the individual does not seem to have caught on to the task, attempt to delete one of the practice trials by hitting the SPACE bar when prompted during the display of the score (you have to be quick) and pressing the MINUS sign.

Alternatively, if the person requires more practice and help, and finally catches on after several trials, press <ESC> to quit and start over. Take the time to enter under the final comment: 'Discount this as practice.'

=====  
Settings  
=====

1...Instructions Default value: YES

Read and amplify the instructions for the patient. The first two trials are considered practice and not counted. Delete subsequent trials by pressing the minus key, until the person understands the task.

2...Feedback Default value: NO

For people who have and are unaware of significant lateral visual field losses the feedback can be emotionally overwhelming. Always start without feedback until you know what problems exist and can introduce feedback gradually.

3...Response Device Default value: KEYBOARD

Use the arrow keys to indicate what was seen. Alternative: mouse - point and click in the direction of the stimulus choices on left and right side of the lower video display. Examiner does this for assessment. Pt may learn later.

4...Symbol Duration Default value: 100

This value is in 1/100 ths of a second. Default is about .6 second. Norms are based on this value: don't change it.

=====  
Results  
=====

NOTE: If printed output was selected when you first started the COGREHAB programs, then

- (1) the printout will contain whatever is displayed on the screen.)
- (2) you may pause the display by pressing the <SPACE> bar. Freezing the display is useful for discussing the results with the patient

Results screen 1: Stimulus - Response Matrix

The computer keeps track of responses for all types of trials which it summarizes in a stimulus-response table. The numbers in this chart represent the number of times a given stimulus combination was followed by a given response. Each column corresponds to one of the nine possible stimulus combinations. Locate a number in a given column and then trace across to the row label (far left) to find out what the response was. Correct responses are reflected in the diagonal of this display; off-diagonal responses are errors.

By examining the stimulus-response table, one can differentiate response patterns indicative of hemianopia (omissions on one side of the display for both single and double presentations) and extinction (omissions and confusions on double presentations only).

Results screen 2: Error summary and analysis.

Here performance is broken down by type of error. "Omissions" occur when a stimulus is not reported; while "confusions" occur when the patient recalls the wrong stimulus. Confusions may be associated with suboptimal acuity, or, if much more common on one side of the display, indicative of a relative (not absolute) visual hemi-field impairment.

Lateral differences are significant and are usually associated with a lateralized neurological impairment in the contralateral hemisphere.

A technical detail: To keep the total number of errors constant, partial credit is taken off for double stimuli, where one is confused and one is omitted: overall, only one trial is wrong.

=====  
Clinical Findings  
=====

SDSST is very sensitive to lateralized differences in peripheral visual response. Compensation is almost impossible, given the short exposure time for the stimuli.

Generally, responding should be nearly perfect (no more than 5 errors out of 45 trials), as long as the individual understood the task and had sufficient practice.

If there is a relative visual field loss, it will be elicited by reduced contrast (either by using 1% light transmitting goggles, neutral density filters, or, informally, by reducing the contrast of the computer monitor). Such patients will respond normally with full contrast, but not with reduced.

Confusional errors usually are associated with reduced near point acuity. Sometimes this happens when an individual attempts to do SDSST while fixating on the center. Similarly an individual with a left homonymous hemianopia who fixates on the extreme left of the monitor (to attempt compensation) will often report the stimuli on the right incorrectly, but never misses them altogether.

=====  
Normative Findings  
=====

Recent findings by Hall (Touro) with young adults confirm Matheson's earlier findings with the Apple version, and our clinical experience with SDSST, namely, that neurologically intact individuals make no more than a handful of errors on the full 45 trial run of SDSST. Mean correct = (sd= ). It is usually clinically significant if the individual has fewer than 40 correct.

Measure	Mean	StDev	Cutoff
SDSST : Total	43.79	1.32	41.15
N = 20: 27.4 yrs	Source: C. Hall		
SDSST : Total	40.70	4.27	32.17
N = 20: 75 yrs	Source: C. Hall		

=====  
Miscellaneous  
=====

Our usual practice is to run SDSST one time with normal contrast. If other procedures (e.g., REACT, perimetric visual field testing) suggest that a relative field loss is present, then we may run through again with reduced contrast displays. If a lateralized pattern of impairment is seen with reduced contrast, but not with normal contrast, suspect a relative (not absolute) visual field impairment.

This program does not run under Windows. You must exit Windows completely, or, in Windows 95, set the properties of the shortcut to force the program to run in DOS mode with a maximized window.

The reason for this requirement is that this program involves precision timing which WINDOWS (an inherently timesharing/multitasking program environment) does not do well. We have opted to maintain the program's timing over the convenience of running in Windows. However, we regret this inconvenience and continue to seek a better solution.

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Visual field deficits after brain injury: Computerized screening.

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=====  
 Variables Saved in \*.CUM Disk File  
 =====

Note: The information below is for use in reading the saved data into a spreadsheet, such as Quattro Pro. With this information one can identify what each measure represents. These procedures are somewhat technical, but useful for comparing performance across sessions.

Seq	Variable	Description	I/D	Chrs		Example
====	=====	=====	===	===	===	=====
1	TASK	PROCEDURE NAME	I	8	D	SDSST
2	NAME	LAST NAME	I	10	D	DOE
3	1ST	FIRST INITIAL	I	1	D	J
4	WHEN	DATE/RUN NO.	I	8	C	05079501
5	THGP	THERAPIST/GROUP	I	8	D	RG\TBI

## SOSH : Search for the Odd Shape

---

An 8 by 8 array of homogeneous shapes ("Martians") is searched for one different shape (a "sleeping" Martian). Search times are recorded from when the display appears to when the ultimately successful response was initiated.

=====  
Purpose  
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This program is designed to detect differences in attention and responsiveness on the two sides of the visual field. It is particularly designed to identify those persons who have a spatial hemi-imperception which affects their ability to scan both sides of a display efficiently and, used in conjunction with SEARCH, it differentiates this skill from shape examination and matching.

The display contains an intermediate level of information compared to REACT (one stimulus in an otherwise empty display) and SEARCH (an 8 x 8 array of heterogeneous shapes). This variation in information density enables one to differentiate hemi-inattention and hemi-imperception.

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Materials  
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No special materials are needed. Each stimulus face is identical.

=====  
Procedure  
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The patient searches an array of identical patterns (which can be interpreted as the heads of little space people) for the "odd" one (the one which appears to have closed its eyes). Using this analogy and the instruction "Find the one that fell asleep", SOSH becomes simple to understand. From trial to trial, the display stays the same; only the location of the target shape changes. Locations throughout the array are sampled and search times are reported and recorded for each. Median search times are computed for left side and right side targets, respectively.

=====  
Settings  
=====

1...Accept, Change, Reset                      Default value: none

A = Accept settings as listed. These settings are based on the settings when this program was last used. C = Change one or more of the listed settings; R= Re-set to standard default values.

---

 2...Feedback Default value: YES

Feedback tends to be motivating, but unobtrusive. Change to no feedback only if you wish to minimize cues that would trigger compensation - usually to demonstrate to patients who think they are compensating well.

 3...Response Device Default value: Keyboard

If the layout of the arrow keys is logical, and the keys are easily reached, they are usually the most convenient and reliable mode of responding. If the mouse is selected, but does not work, check to see that a DOS mouse 'driver' has been loaded.

 4...Time Limit Default value: 30 (secs.)

For patients who are likely to need extra time, we re-set this to a multiple of 30. How long do you want patients to search before giving them help? If the time limit is too short, it can be discouraging.

 5...Response Registration Time Default value: 15 (1.5 s)

Pause threshold for registering a response. During initial evaluation the examiner should enter the response moves. Dwell time should be increased if the patient is making the responses, e.g., to 20 or 25, and keyboarding is inefficient.

 6...Goal Time Default value: 5 secs.

If feedback has been requested, an auditory beep confirms response registration. A double beep is offered for responses which are initiated within this goal time. For therapy one might increase this to 10 sec, or, possibly, 20 sec.

=====

Results

=====

NOTE: If printed output was selected when you first started the COGREHAB programs, then

- (1) the printout will contain whatever is displayed on the screen.)
- (2) you may pause the display by pressing the <SPACE> bar. Freezing the display is useful for discussing the results with the patient

The initial display shows the reaction times in seconds to locate the target in the different screen locations. These times are for correct trials only, since, if an error is made, the same location is retested.

The next display shows mean and median response times for the left and

right sides of the display, as well as the entire display. We use the median search times on the left and right sides to summarize the results for SOSH.

=====  
 Clinical Findings  
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Median response times which differ by more than two sec on the left and right sides, are clinically significant, particularly if responses are consistantly quick on one side.

Overall long response times may reflect difficulty with oculomotor function, including scanning and search. The emphasis is not on recognition and inspection of shapes, but rather on the scanning of visual arrays of information.

Inconsistent response times without any pattern suggests visual inattention.

=====  
 Normative Findings  
 =====

Formal norms are pending; however, the following guideline is offered: Median response times should be about 2.0 sec with all times below 5 sec.

	Measure	Mean	StDev	Cutoff
	=====	=====	=====	=====
SOSH : N = 20: 27.4 yrs	Left average	1.52	0.61	2.74
		Source: C. Hall		
SOSH : N = 20: 75 yrs	Left average	3.04	1.58	6.19
		Source: C. Hall		
SOSH : N = 20: 27.4 yrs	Right average	1.70	0.59	2.88
		Source: C. Hall		
SOSH : N = 20: 75 yrs	Right average	3.65	1.33	6.31
		Source: C. Hall		
SOSH : N = 20: 27.4 yrs	Absolute difference	0.29	0.25	0.79
		Source: C. Hall		
SOSH : N = 20: 75 yrs	Absolute difference	1.22	0.86	2.93
		Source: C. Hall		
SOSH : N = 20: 27.4 yrs	Combined	1.61	0.57	2.76
		Source: C. Hall		
SOSH : N = 20: 75 yrs	Combined	3.34	1.29	5.92
		Source: C. Hall		

SOSH : Standard deviation 0.67 0.44 1.55  
N = 20: 27.4 yrs Source: C. Hall

SOSH : Standard deviation 2.02 1.36 4.74  
N = 20: 75 yrs Source: C. Hall

=====  
Miscellaneous  
=====

If the person does well with normal contrast, explore low contrast. This may be accomplished informally by lowering the contrast on the display monitor. More formally, use lenses which filter all but 1% of the light. These may be obtained in wrap-around glasses which fit over ordinary spectacles. In persons who have a lateralized relative loss of visual responsivity, you will find that response times are differentially lowered on one side of the display; while on the other side, times are relatively unaffected.

This program does not run under Windows. You must exit Windows completely, or, in Windows 95, set the properties of the shortcut to force the program to run in DOS mode with a maximized window.

The reason for this requirement is that this program involves precision timing which WINDOWS (an inherently timesharing/multitasking program environment) does not do well. We have opted to maintain the program's timing over the convenience of running in Windows. However, we regret this inconvenience and continue to seek a better solution.

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Variables Saved in \*.CUM Disk File  
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Note: The information below is for use in reading the saved data into a spreadsheet, such as Quattro Pro. With this information one can identify what each measure represents. These procedures are somewhat technical, but useful for comparing performance across sessions.

Seq	Variable	Description	I/D	Chrs	Example	
====	=====	=====	===	===	=====	
1	TASK	PROCEDURE NAME	I	8	D	SOSH
2	NAME	LAST NAME	I	10	D	DOE
3	1ST	FIRST INITIAL	I	1	D	J
4	WHEN	DATE/RUN NO.	I	8	C	05079501
5	THGP	THERAPIST/GROUP	I	8	D	RG\TBI

## SEARCH : Searching for Shapes

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Based on a classic visual search task by Poppelreuter, this task requires the location of a target shape in an 8 x 8 array of different shapes. The shapes are abstract geometric patterns. Search time is recorded and analyzed by location.

=====  
Purpose  
=====

SEARCH for Shapes is informationally dense and designed to demand much attention to all areas of the display. It is a task which calls for many skills, ranging from visual inspection, short-term visual memory, uniform scanning on both sides of the display, to sustained attention and frustration tolerance.

=====  
Materials  
=====

No special materials are required.

=====  
Procedure  
=====

SEARCH for Shapes involves visual search for the match to a centrally placed abstract pattern in an array of other shapes. None of the shapes is easily named and some are similar to the target. Response time is automatically recorded and displayed together with a distinctive double beep when quicker than a predesignated criterion value.

Explain to the patient that the task is to find the shape that exactly matches the one in the center. When doing an evaluation, it is usually best for the therapist to key in the response after the patient points to the target shape. You may use the arrow keys on the keyboard, or a mouse, to indicate which shape is the match. The response time is the time from the beginning of the display to the first movement of an ultimately correct response. If the patient points to an incorrect shape, it is recorded as an error; however, average response times are computed only for correct trials. Another trial is presented later at the same location to substitute for the incorrect response

A response is finalized by holding the response box at the target location for a distinct interval, known as the 'dwell time.' For this reason it is important to continue moving the response box once a response has been started. If there is any uncertainty, increase the dwell time (see Changing the Settings).

=====  
Settings  
=====

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1...Feedback? Default value: YES

Offer feedback on correctness. In certain evaluation situations one might want to disable feedback. Otherwise, it helps the patient develop insight to have information on how quickly the target was found.

2...Response device Default value: KEYBOARD

The options are keyboard (use arrow keys) or mouse (trackball). Usually this choice is one of convenience. The mouse may be a little unreliable as it is rather sensitive and an inadvertent move may cause a premature "response."

3...Time Limit (sec) Default value: 60

How long do you want the computer to wait before signalling "Time?" The data are cleaner if the time limit is never exceeded; however the task may be dragged out unduly if it is increased too much. We often increase it to 120 sec.

4...Response Registration Time Default value: 15

How long must the response box rest in one spot to register as a completed response? If the patient is pressing the arrow keys, one might increase this to 20 or 25 so that an inadvertent pause does not register as a response.

5...Goal Time (sec) Default value: 10

This is the limit for a desired response time. Responses within this time frame are followed by a positive "double beep." 20 sec is a more relaxed value for those who are challenged by this task.

=====  
Results  
=====

NOTE: If printed output was selected when you first started the COGREHAB programs, then

- (1) the printout will contain whatever is displayed on the screen.)
- (2) you may pause the display by pressing the <SPACE> bar. Freezing the display is useful for discussing the results with the patient

Results screen 1: Display by originally presented location.  
Results are the time in seconds (accurate to hundredths of a second) from the target display until the first movement of the response box towards the target.

---

It is often helpful to ask the patient to analyze this screen, for example, to count how many trials were gotten in less than 10 or 20 sec on the left and right sides respectively.

Results screen 2: Statistical summary.

Mean and median response times are given for the targets on the left, right and both sides of the display, respectively. Also given are the % incorrect and the time limits exceeded. If the mean is noticeably higher than the median, there were one or more excessively long trials. (Remember that in statistics, one very high number in a group will distort the mean and not change the median at all). Practically, if the mean is much higher than the median, you should suspect a lapse, such as would be caused by an attentional lapse, a visual field defect, or even a momentary seizure.

=====  
 Clinical Findings  
 =====

SEARCH challenges a variety of skills:

- (1) shape inspection and matching and
- (2) scanning the entire display

By observation one can often differentiate which of these is affected. In addition, compare the findings from SEARCH with those of SOSH (Search for the Odd Shape) and MATCH (Shape Matching). Problems with shape inspection and matching are suggested if the patient has difficulty with MATCH; while scanning may be implicated by difficulty with SOSH.

=====  
 Normative Findings  
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Norms for SEARCH are from a Master's thesis by Celina Hall of Touro College. Two groups of 20 did SEARCH: a young adult group of students mostly in their 20's and a group of older drivers attending a day program at a senior center.

Response Times: Median / Mean / Standard Deviation

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Left	Right	Both
Students		

Seniors

Relative to REACT and SOSH, response times for SEARCH tend to be highly variable. This variability may be associated with the inherent variation in the complexity of the shapes. This variability means that one should not be too quick to draw conclusions from SEARCH. A more prudent approach would be to run the procedure again, to see if the pattern of results is replicated.

Measure	Mean	StDev	Cutoff
=====	=====	=====	=====

SEARCH : Left average	4.87	2.64	10.15
N = 20: 27.4 yrs	Source: C. Hall		
SEARCH : Left average	13.33	4.11	21.55
N = 20: 75 yrs	Source: C. Hall		
SEARCH : Right average	5.69	1.71	9.11
N = 20: 27.4 yrs	Source: C. Hall		
SEARCH : Right average	11.73	4.09	19.92
N = 20: 75 yrs	Source: C. Hall		
SEARCH : Absolute difference	2.22	1.46	5.13
N = 20: 27.4 yrs	Source: C. Hall		
SEARCH : Absolute difference	3.83	2.37	8.57
N = 20: 75 yrs	Source: C. Hall		
SEARCH : Combined	5.28	1.83	8.94
N = 20: 27.4 yrs	Source: C. Hall		
SEARCH : Combined	12.53	3.52	19.57
N = 20: 75 yrs	Source: C. Hall		
SEARCH : Standard deviation	0.00	0.00	0.00
N = 20: 27.4 yrs	Source: C. Hall		
SEARCH : Standard deviation	0.00	0.00	0.00
N = 20: 75 yrs	Source: C. Hall		

=====  
 Miscellaneous  
 =====

This program does not run under Windows. You must exit Windows completely, or, in Windows 95, set the properties of the shortcut to force the program to run in DOS mode with a maximized window.

The reason for this requirement is that this program involves precision timing which WINDOWS (an inherently timesharing/multitasking program environment) does not do well. We have opted to maintain the program's timing over the convenience of running in Windows. However, we regret this inconvenience and continue to seek a better solution.

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Variables Saved in *.CUM Disk File
=====
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Note: The information below is for use in reading the saved data into a spreadsheet, such as Quattro Pro. With this information one can identify what each measure represents. These procedures are somewhat technical, but useful for comparing performance across sessions.

Seq	Variable	Description	I/D	Chrs	Example
1	TASK	PROCEDURE NAME	I	8	D SEARCH
2	NAME	LAST NAME	I	10	D DOE
3	1ST	FIRST INITIAL	I	1	D J
4	WHEN	DATE/RUN NO.	I	8	C 05079501
5	THGP	THERAPIST/GROUP	I	8	D RG\TBI



# Sample Forms

- A. Specialized Evaluation Services
- B. What happens to your NYS driver's license after a brain injury?
- C. Driving Advisement: Memo of Understanding
- D. Driver Information

## Specialized Evaluation Services

**Driving Advisement.** Computerized driving advisement procedures (Elemental Driving Simulator-EDS and Driving Advisement System-DAS) are for people who are at risk for cognitive impairment (e.g., from a traumatic brain injury, a stroke, or age-related changes) which might affect their ability to drive safely. They may be referred by themselves, their families, therapists or doctors. The tasks present challenges similar to real driving - but without the risk. Dr. Gianutsos, a neuropsychologist and developer of these procedures will personally select and administer the most appropriate procedure. She will give you a copy of a report and discuss her findings and recommendations with you and anyone else you request. The findings are confidential and will be shared with any individual or agency only with your permission.

Since vision is an important ingredient of your competency to drive, it must be addressed in order to make plans regarding driving. If you have been to an optometrist for a thorough examination recently (or since your injury), bring a report from the eye doctor so that Dr. Gianutsos can advise you about possible visual perceptual problems which might affect your driving. Alternatively, you may ask her to do a rehabilitative vision screening (see below).

**Vision Screening.** Dr. Gianutsos conducts a vision screening to address the particular problems and needs of survivors of acquired brain injury. If you have problems, you will be referred to an appropriate vision specialist. Assistance is offered as needed to help you follow through and integrate these recommendations in your rehabilitation plan.

Vision screening goes beyond measurements of clarity of vision (acuity) to address questions concerning the coordinated use of both eyes (binocularity) and the completeness of the field of view. Experience has taught that head injuries and strokes can impair these functions significantly without the individual's awareness. Since treatment is possible and so much of rehabilitation depends on good vision, we urge all survivors to have these visual functions checked by a specialist experienced in rehabilitation and vision. Explanation of the problem(s) and implications for visual perceptual function is an important part of what we offer.

**Time and charges.** All evaluation is billed as a specialized neuropsychological evaluation (CPT code 95883) at the standard Motor Vehicle No-fault/Workers Compensation rate: \$117.11/hr. (9/93-8/94). Driving Advisement usually requires 2 hours, as does Vision Screening. When both are done, it may be possible to complete the procedures in 3 hours.

**Credentials.** Dr. Gianutsos is a licensed Psychologist in New York State. In addition she holds a Certificate as a Driver Rehabilitation Specialist (Neuro-Sensory) from the Association of Driver Educators for the Disabled. She is a former member of the Medical Advisory Board of the NYS Department of Motor Vehicles, where she chaired the Subcommittee on the Elderly and Disabled. She is a Fellow of the American Academy of Optometry and a member of the editorial board of the *Journal of Behavioral Optometry*.

### Checklist

- 1. Memo of Understanding
- 2. Background Information Form
- 3. Insurance forms / check
- 4. Drivers License
- 5. Reading glasses (if used)
- 6. Previous records/reports, as relevant

# What happens to your NYS driver's license after brain injury?

Rosamond Gianutsos, Ph.D.

Neuropsychologist

Certified Driver Rehabilitation Specialist

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Cognitive Rehabilitation Services, 38-25 52nd St. Sunnyside, NY 11104

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*Dr. Gianutsos was a member of the NYS DMV's Medical Advisory Board which met in 1988-9 to review policy. She chaired the Subcommittee for the Elderly and Disabled Driver. She is not currently associated with the DMV. The information below represents her own views and, while every effort has been made to assure accuracy, not official DMV policy.*

---

Whether you can drive safely is *not* what this is about:

**If you have survived a brain injury and you want to drive again, first take the matter up with your doctors and therapists.**

What follows *is* information about the NYS Department of Motor Vehicles' (DMV) rules and procedures concerning your driver's license. For the moment, we assume that you hold a valid NYS operators license to drive an ordinary private car. For trucks, buses and other commercial vehicles the rules are much stricter if you drive interstate.

Your license remains valid until it expires or DMV takes action to suspend or revoke it. Suspension and revocation can be taken for many reasons, including too many points for moving violations or involvement in a crash in which someone was killed. DMV can review your qualifications for licensure if they receive a complaint from another person, including a health care professional who is treating you. However, health care professionals are not encouraged to make reports as you can file a lawsuit for violation of your privacy: the law does not afford them immunity.

So the answer to the question of what happens to your license is, simply, nothing.

*Well ... not quite.*

An issue may come up when you renew your license depending on your answers to the questions which DMV asks all drivers on renewal (which are similar to the questions asked applicants for new licenses).

**Your answers may trigger a request for medical information and a review.** The renewal form is the MV-2M. An older form (MV-2) dated 1/89 is still being distributed. A word to the wise: **interpret these questions literally and answer them honestly.** It is in your interest to inform the DMV about your

status and to keep a copy of any records of your having done so. Should you have a serious accident, no one will be able to claim that you got, or kept, your license when you were not competent and should have known better.

*What are the DMV license renewal questions?*

- ◆ **Since you applied for a license, or since your last renewal was issued: Have you had, or are you being treated for, any of the following, or has a previous condition gotten worse?**
- ◆ **Convulsive disorder, epilepsy, fainting or dizzy spells, or any condition which causes unconsciousness**
- ◆ **Heart ailment**
- ◆ **Hearing impairment**
- ◆ **Lost use of leg, arm, foot, hand or eye**

A review occurs if you answer "yes" to any of the questions.

What kind of health care provider can fill out the DMV forms? The form will often be quite specific. Usually a medical doctor who has treated you in the last 3 months will do; however, in cases of seizure disorders (recurring periods of unconsciousness) a neurologist or neurosurgeon will be needed. The DMV may accept a report from a neuropsychologist or other qualified individual. Such a person should be prepared to explain why they are qualified, and this may add to the time it takes to resolve the matter.

The DMV has a Medical Review unit (Medical Review Unit, Driver Improvement Bureau, New York State Department of Motor Vehicles, Empire State Plaza, Albany, NY 12228 518 474-0774) which has

a medical consultant; however, there is no standing Medical Advisory Board.

If you require a medical report, the doctor will have to sign the following statement: *“the patient’s medical condition would not interfere with his/her safe operation of a motor vehicle.”*

### Specific conditions

#### Vision

- ◆ If you can read at **20/40 or better** on an ordinary eye chart (with or without glasses), you meet DMV’s requirements. If you are aphasic (have language problems), you can have an eye doctor certify on a DMV form which the doctor usually can supply.
- ◆ If you have **lost the use of one eye**, you can still qualify to drive a car, but cannot drive commercially.
- ◆ If your **acuity is between 20/40 and 20/70**, you must submit a report by an eye doctor. These are the only circumstances in which you will have to meet the DMV’s requirements for **visual field** a span of what you can normally see with one eye (140 degrees, or almost 40% of the perimeter of a circle). If you have a **“homonymous hemianopia”** (don’t see one half of the field of view in each eye), you will NOT meet this standard. Strictly speaking, if your acuity is good, you could have tunnel vision and still qualify for a NYS license. This is an obvious **loophole in the regulations**. In many states and most of the rest of the world, you would not even be considered for a license with such a loss of vision. If you have a visual field problem or “neglect,” you will have a difficult time compensating, especially in busy, complex or new situations, or when you are tired or distracted. Most important, you are probably under-aware of your loss - you literally may not see any problem! ... not because you deny or neglect it. The human nervous system normally fills in the gaps (which is only a problem when there are substantial gaps in the field of vision).

#### ***Any condition which causes unconsciousness***

- ◆ This item used to be “Loss of consciousness” and is the one which often leads to medical review for people who were unconscious for a period of time following a head injury. Unless you have a seizure condition (see below), you may have your primary care physician fill out form MV80-U

based on an examination performed within the last 120 days.

#### ***Seizures***

- ◆ Officially, you must be seizure free for a year. In practice, the DMV may accept 6 months. The MV80-U form must be filled out by a board certified/eligible neurologist or neurosurgeon based on an examination performed within the last 120 days.

#### **Tips:**

- ◆ **Renew early** if you anticipate Medical Review. You can renew as much as 6 months before your license expires. Do not wait for DMV to send you renewal forms. The Medical Review process takes time, up to 6 weeks DMV estimates. If you have to supply further information, it’s another 6 weeks. Begin early and you won’t be grounded while they review it.
- ◆ **Renew late** if you need time to recover. You have up to 2 years following your license expiration to renew using ordinary procedures. While, during that year, you cannot drive, you will not necessarily have to take a written or road test and be treated like a new driver.
- ◆ **Driving against medical advice**, or when a “reasonable person” would know better, is **negligent**. You could be sued and, possibly, be held criminally responsible - just as you should be if you hurt someone while driving intoxicated.

#### **Comment**

Some people think it is shocking that doctors are not required to report people with conditions which might affect driving to DMV. This “mandatory reporting” exists in a handful of states and is inconsistently applied, like the 55 mph speed limit. It forces your doctor to wear two hats: as your doctor and as an agent of the state. Some drivers would not seek treatment if they thought it might jeopardize their license. Given the right information, in an understandable form, the vast majority of drivers will, perhaps reluctantly, make the right decision.

# Driving Advisement: Memo of Understanding

The computerized driving advisement procedures (Driving Advisement System/Elemental Driving Simulator) have been developed to help people find out if they have necessary cognitive skills for driving safely. Driving is a very serious matter, because, as many of us are painfully aware, grave injury can be caused by crashes. Not only do drivers risk their own safety, but also that of other drivers, passengers, pedestrians and cyclists as well. It is hoped that these services will give useful information to help would-be drivers to make informed decisions.

- 1. Conclusions based on comparison with how safe drivers do.** What kinds of conclusions can be drawn from these procedures? First, we have tested safe drivers of varying ages on these procedures and will be able to compare how you do to how they did. If you fall within their range of scores, however, you are not guaranteed to be safe on the road. Or, if you fall outside the normal range, it may not mean that you would be unsafe. Hopefully, this information would give you something to consider in your decision making.
- 2. Cognitive only.** These procedures are designed to address the cognitive skills that a content analysis of driving showed to be important. Other areas must also be checked, including: vision, motor function, and neurological status.
- 3. Does not replace road test.** Whatever conclusions either of us draws based on how you do on these tasks should ordinarily be verified by a specialized in-vehicle, on-the-road test by a driving evaluator who has been fully informed of your background.
- 4. Legal requirements are your responsibility.** It is up to you to see that you satisfy the requirements of the law, including having a valid driver's license or learner's permit and insurance. New York State law requires that you answer DMV's questions about disabilities when you renew your license.

**5. Report.** This evaluation is, therefore, strictly advisory. You will receive a summary and explanation of your performance, together with my conclusions and recommendations. Please also send the report to the following individuals:

If an insurance company is paying for these services, you will have to give permission for me to send a copy of my report to the company.

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*Our signatures below signify that we have both read and acknowledge the above statement.*

---

(examinee signature)

---

(observer signature)

---

(examiner signature)

---

(date)

# Background Information Form

Name \_\_\_\_\_ Date of Administration \_\_\_\_\_

Education: (number of years completed) \_\_\_\_\_ Describe \_\_\_\_\_

Occupation:: (current) \_\_\_\_\_

(prior): \_\_\_\_\_

Diagnosis: \_\_\_\_\_ Date of onset: \_\_\_\_\_

Loss of consciousness? Yes / No Duration: \_\_\_\_\_

Seizures? Yes / No

If yes, when was the last one? \_\_\_\_\_ Describe \_\_\_\_\_

## Current Medications:

Drug	Dose	Frequency	Purpose
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Licensure: Never Suspended Expired Current: State \_\_\_ Expiration \_\_\_\_\_

Do you own, or have free access to, a car? \_\_\_\_\_ Describe: \_\_\_\_\_

During last year of driving: .....Miles driven \_\_\_\_\_ Typical use \_\_\_\_\_

During last year of driving:.....Accidents (regardless of fault) \_\_\_\_\_ Describe \_\_\_\_\_

During last year of driving:.....Moving Violations: \_\_\_\_\_ Describe \_\_\_\_\_

If you drive, do you limit yourself in any way? Yes / No

Night? Highways? Other \_\_\_\_\_

Have you ever had a seizure? \_\_\_\_\_ When was the last one? \_\_\_\_\_

Have you ever had a loss of consciousness? \_\_\_\_\_ Describe: \_\_\_\_\_

Any thing else we should know about you? \_\_\_\_\_

What would you like to learn from this evaluation:?

Outcome:

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**Links to readings and sources may be found at**

*<http://www.cogrehab.com/tools/drivertools.php3>*

**Some of the readings are in the section:  
"Resources for Driving Advisement Seminar Registrants"**

**This section requires the following password:**

*seminar.id#*

**Essential Reading**

- A. Gianutsos, A. Campbell, A. Beattie & F. Mandriota, "The Driving Advisement System ..." .....
- B. Gianutsos, "Driving advisement with the Elemental Driving Simulator (EDS) ..." .....
- C. Gianutsos, "A word to survivors of acquired brain injury ...driving" .....
- D. Gianutsos, "Vision screening for driving evaluations of persons with acquired brain injury" ...

**Recommended Reading**

- A. A.H. van Zomeren et al, "Acquired brain damage and driving" .....
- B. Strano, "Effects of visual deficits on ability to drive in traumatically brain -injured population"
- C. Antrim & E.S. Engum, "The driving dilemma and the law ..... : ..."
- D. Gianutsos, "Visual fields: computerized screening"
- E. Physician's Guide to Assessing and Counseling Older Drivers  
<http://www.ama-assn.org/ama/pub/category/10791.html>

**Resources**

- 1) AAA Foundation for Traffic Safety 1440 New York Ave., Suite 201, Washington, DC 20005 202 638-5944
- 2) AAA Traffic Safety Dept., 1000 AAA Drive, Heathrow, Florida 32746-5063 (407) 444-7961
- 3) American Association of Retired Persons (AARP), 601 E Street, NW, Washington, DC 20049
  - - Consumer Affairs
- 4) Association for Driver Rehabilitation Specialists (ADED)
  - Ricardo Cerna, Secretariat, 109 West Street, Edgerton, WI 53534 (608) 884-8833
- 5) KeystoneView 4673 Aircenter Circle, Reno, Nevada 89502 (702) 827-8110
  - (VS-II Deluxe with Standard Tests, Cat # 1135-A, Stock # 815-509 \$1195.)