



The Future of Driving



The Future of Driving





The Future of Driving

- Autonomous driving is not going to mean jump in the car, push a button, and say
'Take me to grandma's house' and go to sleep,'

James Bell, head of consumer affairs for GM



The Future of Driving

- Manufacturers, researchers, and governments must work to establish standards and laws
- Large amounts of information from an array of sensors, cameras and radar systems, to calculate risks and make split-second
- Cost, maintenance, and familiarity





The Future of Driving

- "Is the autonomous car taking over?"

“No: We make it very clear to the driver that you have to keep on driving. Automation is just a support function.”

Filip Brabec, director of product management for Audi



Driving

- A complex activity that involves continuous accurate and timely interaction between visual, cognitive, and motor abilities
- More than 50% of individual with MS are driving
- Failure rates on driving evaluations is between 19% and 42%





Driving

- Current evaluation practices involves the use of many tests
- Lasts about 3 hours and costs >\$500



Driving


- Identify the most important predictors of the driving evaluation outcome
- 44 drivers with relapsing-remitting MS, age = 46 ± 11 years, 84% females, and EDSS between 1 and 7
-



GRU
GEORGIA INSTITUTE OF TECHNOLOGY
AUGUSTA

Driving

- 5 Tests explained 59% of the variance



UFOV

Demonstration: Stroop Test
State the colors as fast as you can


Row 1: Red, Blue, Green, Yellow

Row 2: Yellow, Red, Blue, Red


Row 3: Blue, Yellow, Red, Green

From: John Graham, MD, MS, VA National Center for Patient Safety


Stroop



SDSA - Dir



SDSA - Comp



SDSA - RS

CMS
THE CONSORTIUM OF
MULTIPLE SCLEROSIS CENTERS

GRU
GEORGIA INSTITUTE OF TECHNOLOGY
AUGUSTA

Driving

| Predicted | Road | |
|-----------|------|------|
| | Fail | Pass |
| Fail | 7 | 1 |
| Pass | 3 | 33 |

- Predictive accuracy = $(7+33) / (7 + 1 + 3 + 33) = 91\%$**
- Sensitivity = $(7) / (7 + 3) = 70\%$**
- Specificity = $(33) / (1 + 33) = 97\%$**

CMS
THE CONSORTIUM OF
MULTIPLE SCLEROSIS CENTERS



Validation of the short battery

- 63 drivers with MS, age = 49 ± 9 years, 89% females, and EDSS between 3 and 7
- Off-road tests including the five tests were administered on one day
- Standardized road test was administered on another day by an expert



Validation of the short battery

- Each of the five tests was significantly associated with outcome of the road test
- The five tests explained 44% of the variance





Validation of the short battery

| Predicted | Road | |
|-----------|------|------|
| | Fail | Pass |
| Fail | 6 | 8 |
| Pass | 3 | 46 |

- **Predictive accuracy = $(6+46) / (6 + 8 + 3 + 46) = 83\%$**
- **Sensitivity = $(6) / (6 + 3) = 67\%$**
- **Specificity = $(46) / (8 + 46) = 85\%$**



Validation of the short battery

- Valid predictor of fitness-to-drive of individuals with MS
 - **Pass = recommend for practical road test to make final decision**
 - **Fail = More testing required before a final decision is made**
- Lasts less than 1 hour and should cost >\$150
- More accurate in predicting those who passed the road test





Validation of the short battery

- More individuals passed the road test
- May explain why the battery is better at predicting those who passed
- On-going study to recruit 180 participants
- Finding could have very significant clinical impact



Future activities

- Conducted a pilot study to determine the feasibility of the protocols of a larger randomized controlled intervention study
- Extending the on-going validation study to investigate the relationship between fall risk and driving performance
- Investigate the possibility of simultaneously reducing fall risk and improving driving performance





Acknowledgments

- The Consortium of Multiple Sclerosis Centers
- National Multiple Sclerosis Society
- Georgia Regents University, Augusta GA
- Y'all

