Driving and the Brain

How Can Cognitive Changes Affect Driving Skills?

To grasp the brain's complexity, imagine what it would take to connect six billion people around the world by telephone. Now consider the greater complexity of an estimated 100 billion brain cells, each capable of almost simultaneously connecting to hundreds – and sometimes thousands – of other neurons.

When you drive a car, different regions of your brain cooperate to receive sensory data, prioritize information, recall related past experiences, anticipate likely scenarios, analyze options, and synchronize movement responses.

Nerve connections carried through the brain stem help a driver sense a bump in the road or a skid of the tires. A slight turn of the steering wheel to adjust direction is possible because of stored learned reflexes in the cerebellum. The brain's temporal lobe decodes slight variations in auditory signals, analyzing the position and intensity of sounds – from the car radio, a nearby car's honk or an ambulance siren in the distance.

Countless visual images compete for a driver's attention – the speedometer, the rearview mirror, a speed limit sign, the yellow divider lines, an oncoming truck or a pedestrian in the crosswalk. The frontal lobes allow you to juggle the competing tasks of paying attention to the road in front of you, changing the radio station, being aware of the ambulance in the rearview mirror, watching the speedometer, recalling the directions to your destination, and making a decision of what to do when a child steps of the curb in front of you. Through an elaborate process, different brain parts are responsible for determining shape and color, tracking motion, comparing memory of past experiences, and prioritizing optical signals.

Today's fast-paced roadways can challenge any brain. But what if neurons and connectors in different parts of the brain become diseased or damaged?

Driving with Dementia

Driving with dementia is not just about remembering how to get home. Slower neural connections can delay reaction time. When trying to avert danger, milliseconds matter. A difference of 100 milliseconds in response time can translate into several feet when braking at highway speeds, a difference between life and death.

Safe driving is not just a matter of concentration, as if driving were a single act. A person with dementia can lack the rapid, flexible response patterns needed to handle unusual, unexpected or new situations.

By definition, most types of dementia (e.g., Alzheimer's Disease, Fronto-Temporal Dementia, Vascular Dementia, Dementia with Lewy Bodies) involve a progressive decline in functioning due to the degenerative nature of the brain disease. As such, all people with degenerative dementia will eventually become unable to drive safely.

No two brains are the same. The initial parts of the brain involved in dementia, the progression of the disease, and the profile of cognitive strengths and weaknesses all vary. Although no one knows precisely what happens in an individual's brain during every act of driving, an overview of how the brain works helps us understand how dementia can affect driving.

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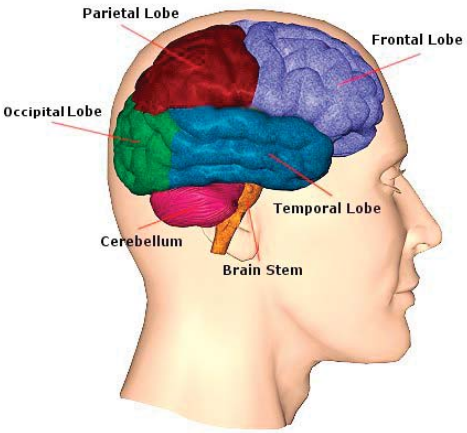

Brain Functions During Driving

The chart shows the main functions of major parts of the brain. As you read about the various functions, which brain parts would you say are essential for good driving?

BRAIN PARTS	FUNCTIONS
Frontal Lobe	• Anticipates potential danger • Decides how to respond to situations • Helps plan, organize and carry out activities • Controls the ability to multi-task • Controls emotional response • Oversees problem-solving and decision-making • Controls memory of habits, muscles, and body movement
Parietal Lobe	• Involves visual-spacial perception • Recognizes movement and manipulation of objects • Integrates signals from all senses • Coordinates visual attention and touch perception
Occipital Lobe	• Controls visual response
Temporal Lobe	• Controls hearing • Manages memory acquisition/storage • Processes some visual perceptions • Categorizes objects
Cerebellum	• Coordinates voluntary muscle movement • Maintains balance • Holds memory for reflex motor actions
Brain Stem	• Controls reflexes • Affects alertness • Affects sense of balance

What Do You Think?

1. Using the information above, what parts of the brain would be necessary for turning on the radio while responding to a yellow light?

2. Are persons with dementia likely to be aware of when they need to limit or stop driving? Why or why not?

3. Are family members always aware of the driving risks when a person has dementia? Why or why not?

4. Based on this information, why would co-piloting – giving instructions on how to drive – be unsafe? Similarly, why might a GPS (global positioning system) make driving more risky for a person with dementia?

5. Why is the family's role important in decisions about driving and dementia?

Resources

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