Neuroscience in the driving seat

December 11 2009, by Jonathan Wood

It emerged today that more drivers are using hand-held mobile phones than two years ago, despite the introduction of tougher penalties. The Transport Research Laboratory is worried because phone-using drivers are four times more likely to crash and their reaction times are likely to be slower.

It may be that a group of neuroscientists at Oxford University can help in dealing with this kind of distraction and improve drivers' reaction times. They believe that understanding the way we respond to danger signals and make life-or-death decisions can enable us to make improvements in car design. Leading car manufacturers are now taking an interest in the hope of making us better, safer drivers.

The problem with using a phone is that talking while driving increases

the risk of an accident. ‘People think that they can do both, but they can’t,’ says Professor Charles Spence of the Department of Experimental Psychology at Oxford University. ‘The brain is configured to respond best to one spatial location at a time. So looking in one direction at the road and listening in another to a caller on the mobile phone at the same time can’t be done well.’

It is now possible to make transparent loudspeakers which can be incorporated into a car windscreen. This enables people to look at the road and listen to a phone conversation coming from the same direction, Charles Spence’s group has shown.

Senses & signals

There’s no doubt that improvements to driving safety are still needed, with 2,538 people killed on the road in 2008 and 26,034 seriously injured. Human error contributes to the vast majority of road accidents, and loss of control of a vehicle or failing to look properly are contributory factors in many of these incidents.

Many new technologies are gradually being added to cars to improve safety. These include sat-navs, hands-free mobile phones, and warning signals. A number of cars now have systems that can sense nearby vehicles and warn the driver when anything gets too close.

But Charles Spence and colleagues believe that the designs that engineers have come up with - using displays, flashing lights, and bleeps - don’t always make it easy for drivers to make decisions based on the information they’re given.

He believes we can do better: ‘All our decisions and actions are based on our senses and go through our brains. Knowledge of how we respond to sights, sounds, touch and feel should enable us to come up with better,

neuroscience-inspired designs for alerting drivers to danger.'

The latest work from Charles' research group, published in the journal *Human Factors*, demonstrates how warning signals given to the driver through the headrest can improve the speed with which they can respond to the danger, potentially reducing the number of front-to-rear-end collisions.

The work makes use of recent neuroscience research showing that the space behind the head, where you can't see what's going on, is treated in a special way by the brain.

'Our brains react immediately and automatically to things happening in that space in a defensive response to potential danger.' says Charles Spence. It is similar to the margin of safety or 'flight zone' seen in many animals.

His group, with funding from Toyota, carried out experiments showing a short warning sound from speakers just behind a driver's head can improve the speed of response to danger by nearly four tenths of a second over warning lights placed further away, like those on a dashboard.

Attracting attention

An alarm signal in the close protective space around the head is better at breaking into the driver's attention, getting the driver to turn their head to where the danger may be (to look in their side mirror for example), and allowing faster decision-making about the need for braking or avoidance actions.

Charles Spence has also shown that the type of sound and the position of a warning signal matters for the driver's response time. 'It is much better

to use a car horn as a warning sound rather than a generic electronic beep, because people know what the sound of a car horn means,' he says. 'If that sound also comes from where the danger is, rather than on the dashboard, you improve a driver's response time by four tenths of a second.'

'Our sense of touch is one of our greatest senses and we don't use it in driving,' he adds. His group has investigated incorporating vibrating signals into seatbelts, the driver's seat, the steering wheel, and the foot pedals. Adding a vibrating warning signal can take another two tenths of a second off response times in driving simulator experiments.

An improvement of five tenths of a second is thought to be enough to reduce front-to-rear-end collisions by 60 per cent, so multisensory warnings that combine vibration, sound, and appropriate location of the signal could make a significant difference to road safety. Volkswagen is hoping to make use of this work.

The neuroscience of our senses could also improve car design in other ways, suggests Professor Spence. 'The sound of a car's engine can affect how we think about a car. You may want a car that sounds powerful or sporty, for example. Rather than engineer that satisfying roar into the engine, it may be simpler to subtly change the sound the driver and passengers hear inside the car and improve the way they feel about their driving experience.'

These ideas can be taken further. He adds: 'You could combine psychology and knowledge of people's likes and dislikes to introduce smells and fragrances into the car interior to relax passengers or perk them up. You could incorporate this with GPS systems to give fragrances according to the environment you're driving through. It may even be possible to make the multisensory experience of a car interior so pleasant that you want to stay sitting there even when you've reached

your destination.’

Provided by Oxford University (news : web)