www.nytimes.com
The New York Times

JUL 31, 2001

Car Calls May Leave Brain Short-Handed

By SANDRA BLAKESLEE

Scientists have bad news for people who think they can deftly drive a car while gabbing on a cell phone.

The first study using magnetic resonance images of brain activity to compare what happens in people's heads when they do one complex task, as opposed to two tasks at a time, reveals a disquieting fact: the brain appears to have a finite amount of space for tasks requiring attention.

When people try to drive in heavy traffic and talk, researchers say, brain activity does not double. The amount of brain activity devoted to each task actually decreases. As a result, people performing two demanding tasks simultaneously do neither one as well as they do each one alone.

The study, published in the Aug. 1 issue of the journal NeuroImage, was led by Dr. Marcel Just, a psychology professor and co- director of the Center for Cognitive Brain Imaging at Carnegie Mellon University in Pittsburgh. While this study did not directly examine the brain activity of people who were driving cars and conversing, it used tasks that engage similar brain regions, Dr. Just said. Moreover, he said, plans are under way to study the brains of people who are using driving simulators while someone is talking to them.

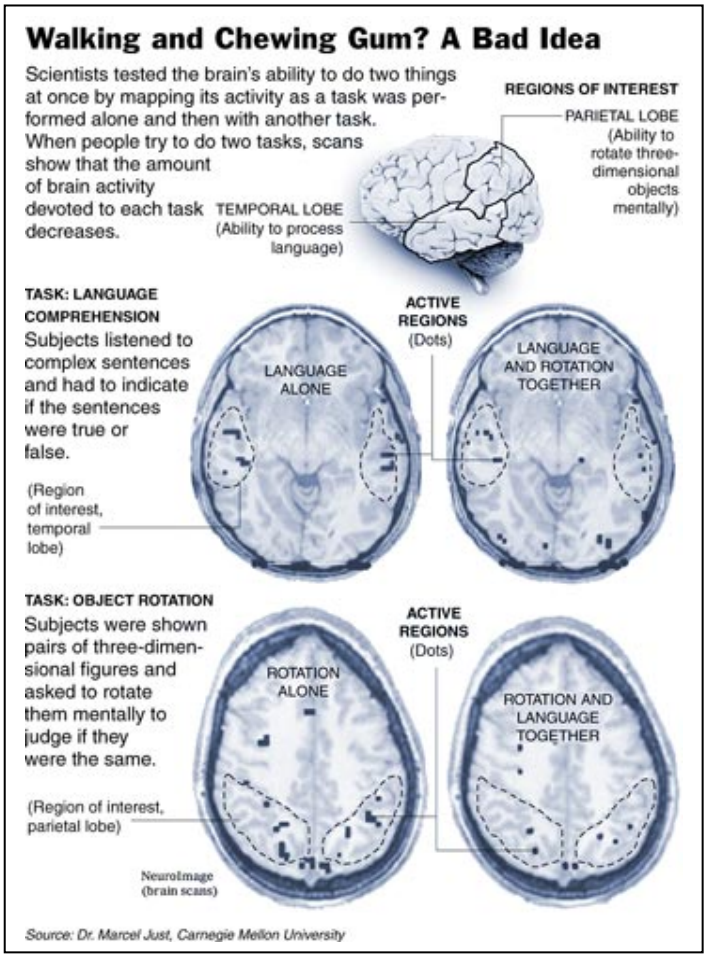
Dr. Jordan Grafman, a neuroscientist at the National Institute of Neurological Diseases and Stroke in Bethesda, Md., said that while the study did not involve cell phones, it was relevant to public policy. "Lawmakers need to know there is a cost whenever people try to do multiple tasks," he said.

Dr. Christof Koch, a professor of cognitive and behavioral biology at the California Institute of Technology, said: "No question this study was very nicely executed. After all, if you really want to listen to something, you close your eyes, right?"

In recent years, it has become possible to map brain areas involved in high level cognitive tasks — processing sentences, comprehending paragraphs, formulating strategies, planning many moves ahead and evaluating uncertainty.

When people do these mental tasks, functional brain imaging machines can detect which areas of their brains become most active. Because active brain cells use more oxygen, they can be seen as hot spots against a background of less active cells.

The active regions are measured in voxels, volumes of brain tissue about the size of a grain of rice. When a particular part of the brain is working hard, more voxels light up.



Previous research showed that when a single area of the brain, like the visual cortex, has to do two things at once, like tracking two objects, there is less brain activation than occurs when it watches one thing at a time, Dr. Just said.

The new study sought to find out whether something similar happened when two highly independent tasks, carried out in very different parts of the brain, were done concurrently. The answer was not obvious, Dr. Just said. Maybe the tasks would work independently and activate twice as much space in the brain. Or they could compete for space and activate a different, and unpredictable, set of brain cells, he said.

Dr. Just and his colleagues chose two tasks for the study. One was language comprehension, which is carried out in the brain's temporal lobe. The other task required mentally rotating objects in space, a process that is done in the parietal lobe.

Eighteen volunteers had their brains scanned while doing one or both tasks. For one scan, they listened to complex sentences like "the pyramids were burial places and they are one of the seven wonders of the ancient world," and had to judge them true or false. For another, they were shown pairs of three dimensional figures and asked to rotate them mentally to decide whether they were the same.

Then they tried to do both tasks simultaneously and equally conscientiously. Researchers confirmed that the two tasks relied on different parts of the brain. The language task alone activated 37 voxels of brain tissue, mostly in temporal regions, Dr. Just said. The mental rotation task alone also activated 37 voxels, mostly in parietal regions.

But when both tasks were done at the same time, the volunteers' brains did not engage the sum of the two, or 74 voxels. Instead, their brains displayed only 42 voxels of activity.

On closer inspection, the researchers found that the number of activated voxels was smaller and less intense in each of the two brain regions. The amount of brain activation generated by mental rotation decreased 29 percent if the person was also listening to a sentence. The amount of

activation generated by listening to sentences decreased 53 percent if the person was also trying to rotate objects.

While the volunteers' overall accuracy did not suffer, Dr. Just said, it took them a bit longer to do each task. If the tasks had been more difficult, their performance would have suffered even more.

It appears that the brain has limits and can only do so much at one time, Dr. Just said. "You can't just keep piping new things through," he said, and expect the brain to keep up. With practice, the brain can become more efficient at carrying out multiple tasks, he added, but performance is never as good as when the tasks are carried out independently.

Everyone has had the experience of trying to do two things at once, like driving a car and talking to a passenger, Dr. Just said. Both speech and driving can become automatic and not very demanding of brain power. But when an experienced driver encounters a sudden increase in complexity — an argument erupts and it also starts to sleet — that driver will probably stop the conversation and pay attention to the road.

The difference between in-person and cell phone conversations is that a passenger can see changing road conditions and will likely shut up when needed, Dr. Just said. The person on the other end of a cell phone does not see these changes and may keep on blathering.

Making cell phones hands-free will not solve the problem of the brain's inability to carry out complex tasks in tandem. And since it is not possible to ban other human conversation in cars, the next best thing is education, Dr. Just said. People need to know that their brains have limits, even if they are under the illusion that multitasking is the wave of the future.